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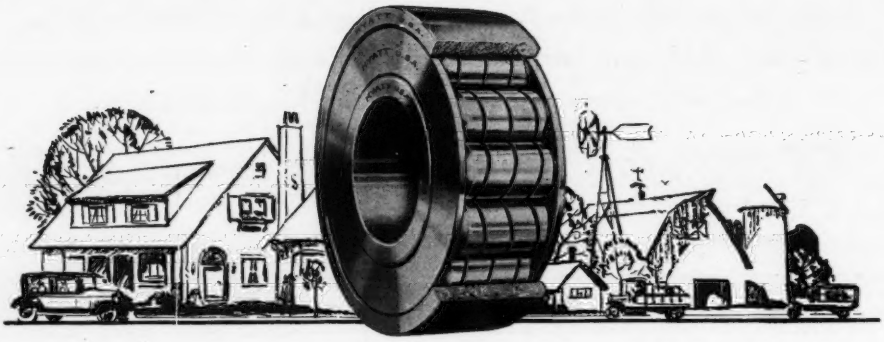

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AGRICULTURAL ENGINEERING

The Journal of Engineering as Applied to Agriculture

Vol. 7 DECEMBER, 1926 No. 12

Stone Removal as a Phase of Land Clearing*

By A. J. Schwantes

Assoc. Mem. A.S.A.E. Assistant Professor of Agricultural Engineering, University of Minnesota

THE term "land clearing" as we ordinarily think of it, includes the removal of brush, stumps, down logs, and other fragments which are the result of tree growth and which interfere with the free use of modern machinery in the tillage of such lands. In Minnesota about one-third of the area of the state is included in the so-called cut-over district. This is the section in which farms are being made out of waste lands from which forests have been removed. Here the area under cultivation on the average farm is still too small to maintain the present livestock population, to supply the local markets with feed and food, and to make possible an economic unit for farming purposes. Brushing and stump removal and the breaking of newly cleared land still claim much of the average settler's time.

Land clearing as described above is carried on more or less in at least three-fifths of the area of the state. The southeast section was formerly heavily wooded and on many farms in this section land is still being cleared of stumps. The reason for this additional clearing is not so much to increase the size of the farms as it is to remove stray stumps from cultivated fields and to clear up small patches of stump and brush land which makes possible the straightening and enlarging of old fields.

As land values rise and the country becomes more thickly settled, there is a gradual tendency toward a more complete and thorough utilization of land which is under cultivation. There is a desire to cultivate each acre more intensely and more economically and to produce more per unit of land area.

It is this desire, or economic pressure as we might call it, which induces farmers in the more developed sections that were formerly heavily wooded to get rid of the occasional stumps in cultivated fields and to clear up small areas which are making fields irregular and inconvenient and costly to cultivate. It is this same motive which stimulates an interest in the removal of boulders from cultivated fields. The boulders may be numerous or sparsely distributed, but wherever they do occur the development of the incentive for their removal is parallel with the rise in land values.

*Paper presented at the 20th annual meeting of the American Society of Agricultural Engineers, at Lake Tahoe, Calif., June, 1926.

In practically all parts of Minnesota we find field stone interfering to a greater or less degree with cultivation. The prevalence of stone, unlike that of brush and stumps, is not confined to any particular section. While they are by no means evenly distributed over the state, nevertheless to a certain extent, at least, their presence is a hindrance to cultivation in practically every county. In some places they are more numerous and troublesome than others. In fact the cost of clearing certain fields of stone would be economically prohibitive. This condition, of course, is true more generally in the cut-over district where land is cheaper than in the older settled territory, and for this reason, the removal of field stone for the purpose of improving cultivation is more important in the more developed parts. In the cut-over district the new settler still has thousands of acres to pick from and he will naturally pick that land which is easiest and cheapest to clear. He will not pick a farm where he must remove both stumps and stones, if he needs to remove only stumps and still have equally valuable and productive land after he has finished clearing.

Thus it is that in a state such as Minnesota stone removal becomes an increasingly more important phase of land clearing as development progresses. Even in certain sections in the midst of the cut-overs, stone is being cleared on a large scale at the present time.

Practically all of the field stone in Minnesota is of granitic type. In some small areas sandstone, and to a lesser extent limestone deposits occur which give rise to those kinds of stones in the fields. In the northeast section where iron ore is mined, large areas of rock outcrop occur and here trap rock forms quite a large portion of the surface stone. Where these outcrops occur, however, there is very little agricultural land, and therefore this type of rock might be excluded from this discussion. It is the granite then which we have to deal with almost entirely.

As has been pointed out previously, the distribution of field stone varies greatly. It is this fact coupled with the wide difference in the size of the individual stones that makes the general problem of their removal so complicated.

Fig. 1. (Left) This special dump wagon makes it possible to unload stone into a ravine or trench quickly and easily. Fig. 2. (Right) A homemade steel hook for rolling out stones

Fig. 3. (Left) This stone carrier is made of two pieces of pipe about 1½ inches in diameter and about 3½ feet long, placed 15 to 18 inches apart and connected with wire to form a basket.
Fig. 4. (Right) A well-built stone fence

In some cases there are only a few boulders, say one or two per acre. These may be very large or they may be comparatively small. In other cases we may have very few large boulders or none at all, but the stones will be of such size that they may easily be handled by one or two men.

Just as in clearing land of brush and stumps one naturally does the easiest clearing first, all other things being equal, so it is quite natural that we are first of all concerned with those conditions where the stones are few and the cost of clearing them off is small. If under these conditions the stones are small, there is not very much of a problem except to pick them and haul them off on a wagon. If, however, they are large then they present a more or less difficult problem. It is one of dealing with the individual stone. This will be taken up later in this discussion.

In certain localities there is a great deal of stone and the expense of removing them may be quite high. It may be said by way of comparison that it is not always possible to estimate the cost of clearing a field of stone as accurately as one can estimate the cost of removing stumps and brush. The amount and kind of material above the ground in the case of brush and stumps furnish a fairly good index as to the cost of clearing. This is not always true of stones because it is quite impossible to estimate the proportion of the stone crop which is below the surface but which would have to be removed. There are of course certain areas that are too stony to justify the cost of clearing them. It may pay, however, to clear certain other areas which are quite stony, in spite of the fact that the cost may be quite high. This would be true where land values are relatively high and as land values rise it becomes profitable to clear certain lands which it did not pay to clear in the past.

For purposes of this discussion of the handling of field stones we may divide them roughly into two classes: First, the large boulders which require explosives or special mechanical devices to handle them; second, those stones which are small enough to be handled readily by one or two men.

In handling the large boulders we have the individual stone to deal with. As has been indicated there are two general methods of procedure: First, it may be broken with explosives into pieces small enough to be handled readily; second, some special mechanical device may be used to remove the whole stone. Which of these two methods to use will depend largely on existing conditions. If the number in question is comparatively small, the use of explosives will perhaps be the most feasible. It might be that some of the boulders are so large that it would be entirely out of the question to handle them mechanically. Such cases, however, would come outside of the scope of this paper, because they offer a special problem where it is decided to remove them from the standpoint of land clearing.

There is another possibility in this connection. Many farmers dig a hole near the stone and bury it to a depth of about 18 inches or two feet. This will be referred to again later.

It is obvious that for the smaller stones which may be handled readily by one or two men it is only a matter of gathering them and hauling them away. At the present time the picking is being done with hand labor. There are a number of implements which may be used to transport stones from the field. Chief among these are the stone boat and the ordinary farm wagon. Some special wagons are used with special facilities for loading or unloading. (See Fig. 1.) Doubtless there are advantages to the use of some of these special devices, but perhaps there are also disadvantages. Stone boats and special wagons with low platforms, for instance, offer advantages so far as loading is concerned. The stone boat, however, offers very distinct disadvantages so far as traction is concerned. Under some conditions, certain of these devices perhaps offer distinct advantages for unloading. It would seem that it should be possible to work out some rather definite relationships between specified conditions and the advantages and disadvantages of the various methods of hauling. At the Minnesota Experiment Station, for instance, we are attempting to determine the maximum distance at which a stone boat may be used rather than a wagon, when all other factors except the hauling distance are equal.

When considering the problem of clearing a field of stone (except in the case of occasional boulders in old cultivated fields) we usually consider it from the standpoint of clearing a field which has never been broken. This may be either in the prairies or in the cut-overs. Usually very few stones are entirely above the surface of the ground. To facilitate breaking and subsequent tillage operations it seems advisable to remove as many of the stones as possible in the first picking. The first operation, then, is to bring those stones, which are partly buried, to the surface. This is accomplished by hand labor with crow bars. It is advisable to have the bars quite long, to give an advantage in prying and to have two men working together. Sometimes this method is supplemented by using a team of horses on a special steel hook which may be made by a blacksmith. (See Fig. 2.) This should have two prongs on it and should have plenty of clearance to take care of fairly large stones.

In this connection we have just begun a study of the relative economy of removing as many stones as possible before breaking or removing only those which are entirely on the surface in the first picking. The particular method which is used doubtless will affect the cultivation of the field for at least two or three years. There is a great saving in labor when the stones are not pried out before breaking, but this may be more than offset by the difficulties which these stones will offer during the breaking and also in the immediately succeeding operations.

We are now confronted with the question of how to dispose of the stone supply. We are all familiar with the scene of the stone pile or several of them placed at random in a cultivated field. Because of their weight, it is rather difficult to make the piles very high and as a result they often not only cover a great deal of ground, but are unsightly and cause a great inconvenience in the cultivation of that field. Around these piles, brush and weeds soon grow up and they form an

Explosives are as much the symbol of the engineer as of the soldier and pioneer. The six-shooter which the agent of law and order carried to tame bad men gives place to the cap crimper carried by the clearing expert in taming bad lands. Whether it be stumps, stones, or swamps that encumber the lands the reverberating boom of shots well estimated and well placed proclaim the art of the engineer in making the materials of death and destruction serve the purposes of peace and prosperity. The beating of swords into plowshares as sung by the prophet of old has its unsung fulfillment in the present-day application of explosives that the earth may bring forth her fruits. And as explosives symbolize the engineer, so do the nicety, economy and dispatch with which he makes them do constructive service exemplify the whole art and science of engineering.

excellent harbor for rodents. Under some conditions it might be advisable to use a gin pole or some other device and pull them up onto a high pile. The sad thing about a stone pile, however, is that it will never rot nor burn.

Some prefer to bury them for the sake of getting them out of the way. There are a number of angles to this question. Some say that the stones will come back to the surface after they have been buried. Perhaps they will; I do not know. We do know, of course, that in a cultivated field, stones have been known to gradually come closer to the surface, but I am not sure whether the stones actually rise or whether the surface is being lowered. It is quite likely that they do actually rise when they are partly out on the surface or at least near enough the surface that the frost affects the largest part of the stone.

If it is found that they can be safely buried then we must determine cost and methods. We have used explosives to quite a large extent for making round holes and trenches for this purpose. First of all, if explosives are going to help us any in this connection, we must have a fairly heavy soil, and it must also be quite moist. We have gotten the cheapest excavation by placing one large charge of about 50 pounds in the bottom of a hole about 10 feet deep. Two men and a team will scrape out most of the loose dirt which is left in the hole in about four or five hours. This hole will hold about 10 cords of stone filled to within 18 inches of the top, and the cost of burying when pyrotol is used is about $1.50 per cord. This does not include the cost of hauling. With trenches and shallow blasts, the cost has run as high as $4.00 per cord. It appears that the deep hole is the most efficient because one gets more space for burying stone per unit of surface dirt removed which must be returned again to cover the stone.

On one farm in Western Minnesota where a large tract is being cleared of stone, explosives are used to blast out the larger ones. This leaves a hole about 5 or 6 feet in diameter and about 3 feet deep containing a considerable amount of loose dirt. A man spends from fifteen minutes to one hour taking out this loose dirt and enlarging the hole to a depth of perhaps 3½ or 4 feet. This is then filled with stone up to within 18 inches of the top and covered with dirt.

In many localities it should be possible to salvage field stone. Neat appearing stone fences have many excuses for their existence but they doubtless also possess many disadvantages. (See Fig. 4.)

Where it is difficult to obtain gravel for road surfacing purposes it might be an economic venture to crush the field stone for this purpose. Crushed rock always has a certain value for concrete work and other purposes. These values need not necessarily be very high to create an added inducement to land clearing.

The cost of clearing land of stone varies considerably. It appears, however, that this is quite often overestimated. This may be due to the fact that stone removal is hard and disagreeable work. In most cases the cost is largely a labor cost in that respect differing somewhat from the clearing of stumps where about one-third of the total cost in Minnesota represents an actual cash outlay for materials. It is impossible to clear a field entirely of stone in one or two years, but with one picking before breaking and perhaps two pickings after breaking (one of which will be made after the field has been harrowed) the stones will not interfere seriously with ordinary farming operations after that. Those that are left are comparatively small but they should be picked once each year.

From a four-acre field in Northern Minnesota from which 43.3 cords were removed in the spring of 1925 in three pickings, only about 1½ cords were removed in the spring of 1926 after the second plowing.

The cost of removing the 43.3 cords was 273½ man-hours and 151.5 horse-hours; or 68.4 man-hours and 37.9 horse-hours per acre. With man labor at 40 cents per hour and horse labor at 15 cents per hour, this cost would be $36.22 per acre including a cost of $3.18 for explosive materials.

At the left, a stump that interfered with tillage. At right, the same stump ready for cutting into firewood after treatment with eight sticks of dynamite

Drainage Extension Work in Ontario

By F. L. Ferguson

Director, Department of Drainage, Ontario Agricultural College

DRAINAGE conditions in Ontario vary considerably with locality. We have our low-lying flat areas, such as are often found in close proximity to large bodies of water. Crossing the international border at Detroit and travelling in an easterly and northerly direction for fifty miles, you pass through a part of Ontario known as the Western Peninsula where because of being bounded by Lake Erie on the south, Lake St. Clair on the west, and Lake Huron on the north, we have conditions that have given rise to large areas of low-lying flat land, land that less than fifty years ago was well under water and practically useless.

By the construction of large dredge ditches, embankments, and pumping schemes we have been able to reclaim thousands of acres of this land and turn it into most profitable agricultural land. Some of this land is largely muck and is particularly suited for the growth of onions, tobacco—34,000 acres in 1926—celery, cabbage, lettuce and other market gardening crops. Other areas and the higher lands vary from clay to sandy loam and are more particularly suited to special crops such at tomatoes, potatoes, sugar beets, and mixed farming crops—corn (with corn borers), wheat, oats, barley, and other grains in smaller areas. Practically this whole peninsula, comprising some 885,000 acres, requires tile draining because of this low-lying, flat topography. This is made possible on the flattest land only by the construction of large dredge ditches for outlets.

In other sections of Ontario we have similar conditions requiring extensive drainage operations, not on such a large scale, but none the less important.

Throughout the central, southern, and eastern counties of Ontario, we have soil conditions not demanding as intensive drainage as the western peninsula, but approximately 95 per cent of the cultivated land would be benefitted by the installation of tile drains, some areas requiring intensive, systematic systems, while others require draining in the low-lying land.

A section of Southern Ontario—what we know as the Niagara escarpment—comprising some 112,000 acres and bordering on the southwestern shore of Lake Ontario, constitutes one of our most important fruit areas. Peaches, sweet cherries, pears, plums, grapes and all bush fruits grow luxuriantly. The soil varies a good deal, but practically all of this area requires tile draining. Because of the value of the land—$1000 to $2000 per acre—the owners can afford to spend money on improvement. Also, because of the intensive nature of the farming carried on, intensive drainage systems are required. In the orchards the drains are placed between every two rows of trees. This saves the trees and improves soil conditions early in the spring, when it is important to get out with the spraying outfits.

In order that these different drainage sections can be looked after as well as possible, a field supervisor has been placed in charge of each. At the present time, we have only four supervisors for the province. This means that each man has a very large area to cover, but during the busy season we put on additional help, usually students during the summer months. At one time all of our field work was done by students, who worked from the middle of April until the middle of September. This was very satisfactory so far as it went, but it left us without field men during the fall, which is often our busiest season, especially so in a wet year such as we have had this summer and fall. Then, too, we were breaking in new men every year, who expected to stay at such work only for a season or two and consequently did not take the same responsibility with regard to the work as they would under other conditions. Neither did this give them a chance to follow up the work to see that the farmer obtained the best results. Our field men now have permanent appointments. As drainage work increases and financial conditions permit, we hope to make other appointments eliminating temporary help and reducing the area each man has to supervise. During that time of the year when field work is impossible, they are used on educational campaigns. These consist of drainage short courses, general agricultural short courses, some of one month and others of three months' duration, farmers' organization meetings and other public gatherings where drainage work is of interest.

The field supervisor's duties so far as his field work is concerned are as follows:

1. To survey and prepare drainage plans for the farmer, giving him the most economic system, the location of his drains, number and size of tile, depths and all the necessary information for his scheme.
2. To follow up the work of installation, if the farmer requests it, to see that the work is properly installed.
3. To advise with regard to the possible way of getting outlets—where a number of farmers are interested—without getting into the law courts and other avenues of spending their money foolishly.
4. To assist the farmer in securing financial assistance by means of government loans with which to do his drainage work.
5. To put on field demonstrations whenever conditions are favorable or where he can find sufficient interest in the work.
6. To conduct evening meetings to discuss drainage problems.

The plans, prepared by the field men are sent in to the central office at the Ontario Agricultural College at Guelph, where they are checked over, redrafted and blueprinted. The blueprints are sent to the farmer. The original and the tracing are filed away for further reference. Perhaps I should add that there is a small charge made for doing this work, not enough to deter anyone, but enough to eliminate the fellow who wants a blueprint of his farm and doesn't intend to use it.

One of our big drainage problems has been the financing of the work. This condition has been met fairly well by the Ontario legislature, which has set apart $2,000,000 to be used for this work. The farmer obtains it through his municipal council which prepares debentures and sells them to the government. The individual can obtain 75 per cent of the cost of his drainage work up to $2000 per hundred acres. He pays 5 per cent interest on this and has twenty years to pay off the loan. This makes his yearly payments very easy and the tile have ample time to pay for themselves. We consider this financial arrangement one of the most satisfactory schemes in connection with this work. Last year $257,900 was advanced to the farmers throughout Ontario for drainage work.

In drainage work is exemplified one way in which agricultural engineering is something broader than farm engineering, and, at the same time, something quite different from any or all of the fundamental branches of engineering to which agricultural engineering very frankly gives credit for much of its technique.

Rural Electric Service from the Western Standpoint*

By L. J. Fletcher

Mem. A.S.A.E. Professor of Agricultural Engineering, University of California. Chairman, California Committee on the Relation of Electricity to Agriculture

NOTWITHSTANDING the tendency of most people to define rural electric service as a means of extending into rural districts high voltage central station electric lines from which extensions can be made to individual farms, it must be borne in mind that the individual electric plant has been the means of introducing electric service into many thousands of farms in the United States by providing energy for lighting and small power purposes, and serving the broader purpose of paving the way and creating the desire for more extensive use of electricity for heating and heavy power purposes.

Among the twenty states now conducting organized investigations of farm application of electricity are the strictly western states of Washington, Oregon, Idaho, and California. The state committees of Oregon and Washington have issued progress reports, including definite information concerning the use of electricity for a large variety of operations exclusively or chiefly agricultural in their nature. Idaho is working on a somewhat similar definite program. In California the work was organized in the summer of 1924 and so far there have been issued five progress reports covering respectively the subjects of stationary spraying, brooding, milking machines, water heaters, and dairy sterilizing, and work is now being done on a report on dehydrators. Considerable work has been done on a statewide survey of the use of electricity, as well as an investigation of the rural electric load of the various electric utilities.

As a by-product of the California committee's work may be mentioned the development of a complete and satisfactory form of sales contract and guarantee between the seller and buyer of irrigation pumping equipment. This need for a better and more uniform contract was met by the committee furnishing a common ground for agricultural representatives and manufacturers of irrigation pumping equipment, and after a large number of conferences the new form of contract is ready for adoption.

In line with the desire of the national committee that the various states perform fundamental investigations in new fields there may be cited as an example the California investigation of the development of an electric dairy sterilizer. As in many states where the law requires that all utensils and containers be subjected to certain conditions of heat, it is required in California that the containers are to be thoroughly washed and afterwards sterilized by exposure to water or water vapor at a temperature of 170 degrees Fahrenheit for at least fifteen minutes. Reports from the state dairy inspectors indicated that there was need for an electric sterilizer owing to its more or less automatic operation and to the facts that it would not taint the milk with an undesirable flavor and would have a rather low fire risk. At the beginning of the study there was only one type of electrically heated sterilizer being built in California, and of it only a few had been sold. The committee's study went into the requirements of an electric sterilizer and tests were run on several designs. Studies also were made of sterilizers on farms. In consequence there is now available a definite set of requirements for electric dairy sterilizers and at least three companies are building sterilizers to meet these requirements.

Quotation is made from the paper presented by Arthur Huntington, chairman of the Rural Electric Division of the American Society of Agricultural Engineers, presented at the twentieth annual meeting of the Society and printed in the September, 1926, isue of AGRICULTURAL ENGINEERING, which develops the fundamental similarity between industry and agriculture and the differences in methods, machinery, and use of power which were held to be largely responsible for the relatively inferior position of American agriculture.

Continuing the author says: "I wish to point out, however, that in some of our rural districts today there is but little difference between the farm and what is commonly known as industry. For example, in Petaluma, a poultry producing section in California, a commercial hatchery is pointed out as a big industry when producing 25,000 chicks per day. Six miles from this hatchery on the farm of E. O. Hussey are located thirty-two electrically operated incubators of 600-egg capacity, sixteen electrically heated brooders, 400-chick capacity, and electrically operated pump and grinder. Mr. Hussey and one hired helper are busy the year around and the load factor on his power equipment is very high."

Relative to the special position of the western area in

*Abstract of paper presented at the 4th annual Western Regional Farm Bureau Conference at Reno, Nevada, July, 1926.

Rural electrification is essentially a matter of developing a profitable load, and that, in turn, is a problem in the engineering of profitable applications for electricity on the farm. It is therefore a problem in agricultural rather than electrical engineering. As such it has been taken up with vision and determination by the agricultural engineering profession, and it is significant that real progress in rural electrification began when the agricultural engineers were enlisted and organized to that end. The picture opposite shows wood splitting being down electrically

the rural electrification program, it is pertinent to point out that in the eleven western states are located 7.4 per cent of all the farms of the United States; 7.4 per cent of the farm population; 8 per cent of the agricultural workers; and 10.7 per cent of the improved land in farms. Contrasted with these percentages is the fact that on these farms is installed 15 per cent of the total primary horsepower, and that 26.5 per cent of all the mechanical energy used on farms in the United States is utilized in these eleven states, and that in them the horsepower-hour per farm worker averages 3230 as compared with 1500 for the United States as a whole. In these eleven states 60 per cent of all the power used on the farm is furnished by electric motors, tractors, gas engines, motor trucks, and windmills. In California 47 per cent of the total energy used on farms is furnished by electric motors at a cost which is about 16 per cent of the total power used. In the national survey of farm power reported in U.S.D.A. Bulletin 1348, it is pointed out that work animals furnish 60 per cent of the total power utilized on American farms, and that this power accounts for 81 per cent of the total power cost.

In eight of these eleven western states the net income per farm worker is higher than the average for the United States, and the three leading states are in this group. While not susceptible to direct proof that the extensive use of power, particularly mechanical, has a direct influence on farm income, careful studies of the relation between farm income and power utilization, particularly mechanical power, not only in various states in this country but in foreign countries, point strongly to the conclusion that there is a casual relation between the amount of power used per worker and the returns from his labor.

In the course of a conference held recently in Chicago, there was made the statement: "Unfortunately, approximately 67 per cent of the potential water power lies in and west of the Rocky Mountains, while only 10 per cent of the population is settling there." While this situation may be construed as unfortunate from the standpoint of the 90 per cent, it has a meaning quite different in its promise for the agricultural development of the West. But in relation to the tendency of most people to assume that hydroelectric energy should be much cheaper than that generated in steam plants, it is well to quote from L. S. Ready, of the Railway Commission of California, ("Factors Entering into the Cost of Electric Energy," Journal of Electricity, July 15, 1926) that hydroelectric power costs about 0.4 cents per kilowatt-hour at the point of generation, and that an amount almost equal is required to transport it to the substations near the point of utilization, making the total cost of delivered energy nearly equal to that of the steam plant, which is usually located in or near the center of maximum utilization.

Irrigation is a large factor in the rural electrification of the west; operation of irrigation pumps by electric motors offers what is known as a base load and in many cases furnishes the necessary power and resulting revenue which have justified the initial extension of the central station service. In California it is estimated that 80 per cent of the electricity used on the farms is utilized for the operation of irrigation pumps, the remaining 20 per cent being used in farm homes and in furnishing electric light, power and heat for a variety of agricultural production processes.

The revenue derived from this rural load is derived about half and half from the irrigation and from the other classes of service. The apparent inequity of an arrangement which charges as much for 20 per cent of the current generated as for the other 80 per cent is explained by the well accepted fact that different classes of electric service are of different values to the consumer. At this point the author refers to and quotes from the paper by L. S. Wing, engineer of the California Farm Bureau Federation, entitled "Rural Electrification from an Economic and Engineering Standpoint," presented at the twentieth annual meeting of the A.S.A.E. (abstracted in the October, 1926, issue of AGRICULTURAL ENGINEERING, and published in full in the 1926 A.S.A.E. Transactions).

With the large amount of rural electric research under way there now appears the problem of extending the knowledge gained. Quotation is made from the 1925 annual report of J. P. Fairbank, extension specialist in agricultural engineering, University of California, as an example of the part taken by the extension service. This project has to do with "the principles of lighting the farm home," and involves a demonstration lecture of about one and one-quarter hours showing the abuse to which eyes are subjected by prevailing methods of lighting and how the requirements for good vision may be simply and cheaply attained in lighting a kitchen.

Another outstanding example of accomplishment through cooperation between the farm bureau extension service and power companies is found in the case of the electification of many of the rural districts in Lassen County, California. President Lawson, of the farm bureau, his directors, and M. D. Collins, farm advisor, realized that electric service would materially improve living conditions on the farms of the county. After being convinced that electric service was desirable and entering on the program with determination it appeared that the prices and plan as presented by the electric company would be prohibitive, so the farmers sent a committeeman to interview the Railroad Commission in San Francisco regarding this matter. The Commission practically cut the rate in half and gave another plan which was feasible. The upshot of the whole matter is that electric service has been extended to a large number of communities in Lassen County and a number of new projects are under way. A noteworthy feature in this program has been the working out of a plan whereby the farmers furnish poles, dig holes, erect the poles and furnish other labor to such an extent that in some cases their advance to the power company was entirely taken care of and they had a credit surplus equivalent to six months service. This work was all done according to a careful plan worked out between the engineers for the power company and the farm bureau. It is stated that the success of this work is due to the complete cooperation of all parties concerned and this in turn has been facilitated by the fact that only short extensions were undertaken, permitting each one to be accomplished by only a few persons, with correspondingly great opportunity for close cooperation.

In Clark County, South Dakota, the highway officials planned a higher grade, to cost $1,000, through the slough at the left. The county agent brought it to the attention of the extension engineer. The sequel is that the slough was drained, as shown at right, at a cost of $389.50, plus some items not borne by the road funds

The World Power Conference

By E. A. Stewart

Mem. A.S.A.E. Associate Professor of Agricultural Engineering, University of Minnesota

REPRESENTATIVES from thirty-eight countries met at Basel, Switzerland, from August 30 to September 8, for the second meeting of the World Power Conference. About four hundred delegates and participants were present. Ten delegates from the United States were present. Someone has said, "The meeting was a technical league of nations." This appellation is rather fitting for such a cosmopolitan group.

The first meeting of the World Power Conference was held in London in 1924 and was a general session. The meeting at Basel was a sectional meeting for the consideration of technical problems. The program was organized under five sections as follows: Group A, Utilization of Water Power and Inland Navigation; Group B, Exchange of Electrical Energy between Countries; Group C, the Economic Relation between Energy produced Hydraulically and that produced Thermally; Group D, Electricity in Agriculture; Group E, Railway Electrification. Eighty-three papers were offered for discussion at the meetings, forty-two of these being in Group A. This group was emphasized more than any other because the World Power Conference was held in conjunction with the International Exposition for Inland Navigation and Utilization of Hydraulic Power. About fourteen countries of Europe had national exhibits of high quality at this exposition. Twenty-seven of the papers were given in English.

The papers to be presented at this meeting were abstracted by six (two in Group A) Swiss general reporters. None of the papers were read at the meetings, but the general reporters gave a report for each group which included abstracts from the papers together with important conclusions and recommendations for topics of discussion. After the general report of each group was given, the subject was then thrown open for general discussion.

The Conference was opened Tuesday morning by addresses by Dr. E. Tissot, Basel, Switzerland, chairman, Swiss National Committee; and by Mr. D. N. Dunlop, London, England, chairman, International Executive Council. Dr. E. Chuard gave an address of welcome as official representative of the Swiss federal government. Mr. Dunlop pointed out in this address that the 4,000,000-kilowatt installed generating capacity in the "Alpine Block," consisting of Northern Italy, Switzerland, Austria, Eastern France, and Bavaria is an example of cooperation for other countries in other fields. The Swiss exports of electricity had increased from 377,000,000 kilowatt-hours in 1920 to 655,000,000 kilowatt-hours in 1925 to the four countries surrounding Switzerland. This indicates further progress in cooperation between technical interests in the different countries.

The technical sessions were started Tuesday afternoon with a discussion of the papers in Group A. Each group met in two or three half day sessions for discussions. Some of the groups ran parallel sessions so as to have more time for discussion. The fact that most all discussions had to be translated into two other languages made the program move along slowly. Those interested in electricity in agriculture held an extra session on Friday afternoon so as to carry out the discussion more completely. This group also remained in session one noon period in order to see three films shown. The three films were a one-reel film of farming in Sweden by Dr. Enstrom, a one-reel film of electro-farming operations at East Grinstead, England, by R. Borlase Matthews, and the three-reel film on "The Red Wing Line" which was produced by the Minnesota State Committee on the Relation of Electricity to Agriculture.

The general reporters remarks on the papers dealing with the utilization of water power brought forth considerable discussion. One subject discussed at length was why the efficiency of American turbines is always given as several per cent higher than the efficiency of corresponding European designs. There is some question as to whether this is a fact or whether it is a result of difference in the methods of measurement. This question was brought up again on Wednesday morning. Three proposals were made for a committee to work on the solution of this problem: First, a special committee to decide upon "generally applicable units for water measurement and the determination of efficiency"; second, place the matter in the hands of the present Commission Electrotechnique Internationale; and, third, appoint a technical committee to work with the International Commission. The matter was finally referred to the executive council of the World Power Conference to decide how this problem should be attacked.

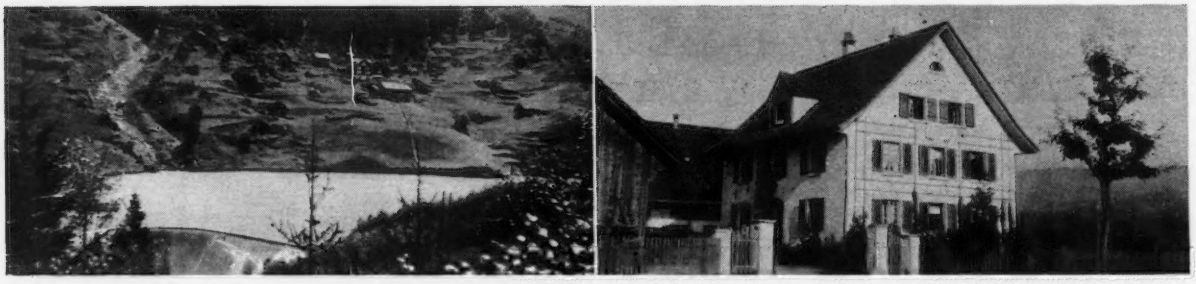
At one noon session a moving picture of the new type of adjustable blade turbine developed by Prof. Viktor Kaplan and its installation at Lilla Edet, Sweden, was shown. This turbine runner weighs 62.5 tons. This turbine when installed showed an average efficiency of 90 per cent between 2600 and 10,500 horsepower with a maximum efficiency of 92.8 per cent. In running the tests of the equipment after it was installed, over 25 miles of recording paper were used on water measuring, and they measured up to 200 tons of water per second.

The sectional meeting on inland navigation discussed such phases as accumulation of water and regulation of water level above dams on streams used for power and navigation, the problem of solid matter and its change in distribution when water in a navigable stream is utilized for power, and some discussion on the type of propulsion for vessels used in inland navigation.

The discussions on the exchange of electrical energy between countries centered quite largely around the conditions encountered in central Europe. Six papers were presented in this group. The interchange of energy between countries is still in its infancy and while it is so, it behooves the electrical interests to work with the International Electrotechnical Commission to develop this exchange and to standardize methods of exchange.

The discussion of the twelve papers in Group C, dealing with the economic relation between electrical energy produced hydraulically and electrical energy produced thermally, centered quite largely around the problem of determining the "consumption time" as a critical unit for determining which type of plant it is economical to use. In some types of water power plants, such as a river power station, M. Arbelot of France thinks that 5000 hours of use per year at full capacity must be guaranteed. In Sweden, due to their natural water regulation, Mr. Enstrom thinks that their "consumption time" exceeds 6000 hours. The quite generally expressed opinion was that wherever hydraulic stations could be developed within reasonable distance of the consumption area, that is was economical to develop them regardless of the type of load. The power requirements of any district can usually be divided into two groups, one with a "consumption time" greater than the critical value for hydraulic power, and the other less. Therefore, hydraulic power, if available, can be developed to take care of the former part.

The meetings of Group D were held parallel with those of Group E. The delegates divided about half and half in attendance. There were nine papers presented at the meetings of this section. The discussion brought out very clearly that the utilization of electricity in agriculture is a very important phase of electrification. Representatives from those countries where nothing has been done towards electrification of agriculture were very much surprised at the advance made in other countries. After the showing of the "Red Wing" film, Sir John Snell remarked, "That is characteristic of you Americans; when you go after a thing, you go after it to solve it."



(Left) Head waters of the power plant at Amsteg, Switzerland. The masonry dam is 85 feet high and is built of stone blocks. A typical farm scene is shown in the background. A number of stone walls will be noted, the purpose of which is to retain the soil. (Right) This farm home near Zurich, Switzerland is one of the most modern types. It was built in 1923. The house is not connected with the barn, but stands about 20 feet from it, one of the few so built

A very large number of the discussions touched on the question of tariffs or rates for electric service. The discussions brought out the fact that many of the rate schedules in Europe were based on items which have never been used or long discarded as a basis for rates in this country. The fixed charges or minimum charges are frequently based on the area of the farm or else on the taxable value of the buildings on the farm. In other cases the minimum bill is based on the number of lamps used. Some companies have two or three schedules for electric service, which makes a complicated rate and involves the use of two or more meters. Since a great deal of the electricity is generated by water power, many of the countries have rates which involve a night rate and a day rate. This requires expensive two-schedule meters. In fact, I found companies which separated the energy into three periods of consumption and used a very expensive meter and time switch arrangement for measuring the energy. Most of the speakers appear to favor a rate something of the type that has been in use at Red Wing, Minnesota, namely, the use of a fairly high basic charge and a low energy rate. A large number of customers are served without meters, but the opinion as expressed by the delegates was that most farmers wanted meters.

Many of the papers, and the accompanying discussions by European workers, brought out the desirability of developing night loads. Since a large amount of the electricity now used is generated by water power, it is imperative that large daytime peaks be prevented. Most of the countries give rates for energy used at night at from one-half to one-third of the daytime price.

The use of electricity for a variety of purposes was brought out. Dr. Kamo of Japan pointed out that electric lights are being used to kill moths and other insects that are injurious to the rice fields. Mr. Kitson of British West Africa cited a case where electric lights are used to frighten the rhinoceroses away from the cane fields at night. He also cited uses for electricity in drying tea leaves and cocoa nibs, and the use of ultra-violet light for curing leaf diseases on plants.

Plowing by the use of electric motors was the topic of a paper by R. Borlase Matthews of England. This paper was discussed by M. Bitouzet of Paris and by Dr. Wallem of Berlin. The system used by M. Bitouzet is a double haulage system for the large outfits and single haulage for the small outfits. In both cases double plows of the Fowler type are used. They now have seven plowing outfits in use and contemplate building eight more for use next year.

Such uses as drying of hay, electro-culture of plants, milking machines, sterilizing machines for the dairy and for wine making, spraying outfits, liquid manure pumps, threshing machines, electro-silage conservation, electric cooking for the house and for hogs, and electric heating of greenhouses, were discussed at some length. Mr. Petri of Stettin, Germany, made a very important suggestion. He stated, "It seems like a waste of time and energy for two or more electrical manufacturing companies to compete with each other in trying to manufacture the same articles; each should specialize on equipment for certain uses and secure better results at lower cost."

The suggestion was made by R. Borlase Matthews of England that an international Committee be appointed to study the subject of electricity in agriculture and report at the next meeting of the World Power Conference. This was discussed at considerable length. Most of the opposition seemed to come from the French delegates. Upon motion made by the writer, the subject was disposed of by instructing the chairman, Dr. Kamo, to refer to the executive council of the World Power Conference the desire of the group to have an international committee appointed to study the application of electricity to agriculture.

The discussion of the fourteen papers in Group E was very spirited. Most of the delegates were very optimistic about railway electrification. Several times during the discussion, the subject of the advantages and disadvantages of the different types of railway electrification was brought up. It was pretty well agreed that in most of the countries electric traction had developed far enough now so that the type of electrification for each country or large railway system was practically fixed. The paper on Railroad Electrification by William S. Murray brought out much comment. He pointed out that high-voltage, direct-current operation for railway operation should be made the future standard system.

Any account of the World Power Conference would not be complete without reference to the fine spirit of comradeship exhibited between all delegates. The opinion was expressed many times that such meetings would help a great deal in promoting international cooperation and world peace. The reception given the delegates by the Swiss National Committee was marvelous. The entertainment program which consisted of a formal banquet on Tuesday evening, followed by entertainment and a dance; the Revue on Wednesday evening; dinner, entertainment and a dance at the Casino on Friday evening, and the special opera program provided for the following Tuesday evening, was enjoyed by everyone. The numerous trips planned by the cooperation of the Swiss National Committee, the Cantons of Basel and Zurich, the Swiss federal railways, and others were of more value than some parts of the technical program. Delegates were given an opportunity to visit the Rhine harbor at Basel, the power stations at Augst, Amsteg, and Waggital. The Swiss federal railways took the delegates by two special trains from Basel to Goschenen, and to the top of the St. Gotthard Pass at Andermatt. Picnic dinner was served by the federal railways and then on Saturday afternoon the delegates were taken back to Luzern. Several trips around Luzern were arranged for Sunday and the delegates were taken back to Basel on Sunday evening. The crowning feature of the program was a banquet given by the visiting delegates in honor of the Swiss National Committee. This was held in the famous old "Restaurant Schutzenhaus," which has its rooms in the original condition as built in the fifteenth century.

The large amount of time devoted to trips, entertainments and social functions gave the delegates an opportunity to get acquainted. This was very essential when it is known that eighteen different languages were represented at the meeting, and even "Pat" (L. J. Kettle of Dublin) talked in his native tongue.

The Place of Metal Roofs in the Reduction of Farm Fire Hazards

IT IS generally accepted that of the fire hazards to which farm buildings are exposed, and which may be classified as external in nature, lightning is the most important, with wind-borne burning brands occupying second place. Of less importance are the hazards of fire communication by radiation from adjacent fires, and communication with other fires by connecting links of combustible materials. Causes of fire which may be classified as internal in origin will not be considered here, as they are seldom, if ever, influenced by the materials and construction of roofs.

Lightning, as a cause of farm building fires, is too well known to call for extended discussion, either as regards the enormity of losses incurred or as to the precise behavior of lightning discharges in starting such fires. It is well known that lightning rods, competently designed, honestly installed, and adequately maintained afford a very high degree of protection. With a proper number and location of points, static electricity is dissipated into the air with sufficient rapidity that in the vast majority of cases potentials do not build up to such a point that disruptive discharge, or lightning stroke, occurs and in the small proportion of cases in which the accumulation of static charge is too rapid for dissipation, the ensuing lightning stroke is led harmlessly to the ground by the lightning-rod system in at least 90 per cent of such cases, according to studies by insurance companies and others.

When a building is roofed with metal sheets in electrical communication with one another and the roof as a whole is connected by a conductor, adequate in carrying capacity and with joints of permanently low resistance to a good earth contact, such a roof constitutes an effective electrostatic shield over the entire top of a building, and there is reason to believe that it constitutes the most effective lightning protection now available and economically practicable for buildings of ordinary construction. While investigations in this direction have not been so extensive as in the case of lightning rods, considerable study has been and is being given to the effectiveness of sheet metal roofs as a means of lightning protection, and the data thus far collected fails to show a single case of fire arising from lightning striking a building with properly grounded sheet metal roof. It should be noted, however, that a sheet metal roof is of itself no guarantee of protection, although it may by chance, through a well-grounded eavetrough and conductor pipe system, give adequate lightning protection without any definite precaution for that purpose. Rather the metal roof is to be considered as a part of a lightning rod or grounding system whereby the effectiveness of such system is materially enhanced.

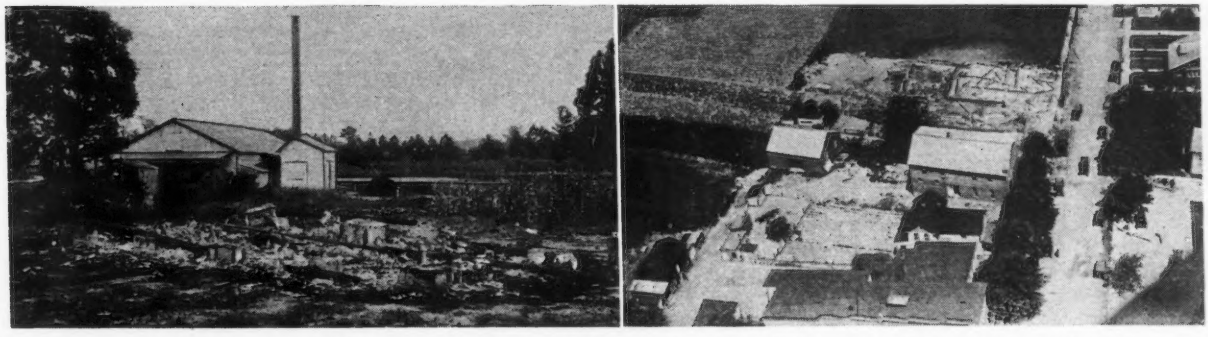
It is proper at this point to observe that while copper, zinc, lead, and possibly other metals have been used for roofing purposes, their cost usually is deemed prohibitive for ordinary farm buildings, so that the term "sheet metal" for practical purposes means iron or steel, usually the latter, in recent years, and usually with a protective coating of one sort or another. However, the nature of the coating has little or no influence in fire protection.

With respect to burning brands from other fires, particles of soot from chimneys burning out, etc., it may be said first of all that sheet steel or iron is completely and absolutely incombustible, a distinction shared by no other roofing material of comparable cost. It may be pointed out further that a sheet metal roof properly applied has no cracks or crevices through which sparks may be driven by the wind. Some evidence as to the practical effectiveness of sheet metal roofs in resisting the hazards from closely adjacent fires is shown in the accompanying illustrations, one of which shows the ruins of a small home in Bozeman, Maryland, struck by lightning on August 9, 1925, and completely destroyed, while the metal-roofed building with the tall metal smoke stack escaped injury. In the other view, taken by airplane, is shown the destruction wrought by fire originating from lightning striking one building and spreading to others. In the middle of the picture immediately in front of the burned area are two metal-roofed buildings which are given credit for stopping the course of the fire and preventing its spread to other buildings in the immediate foreground. The photographs from which these illustrations were made were taken by Lyon, Conklin & Company, Baltimore, Maryland, in connection with investigations of lightning and fire which they have been carrying on for more than ten years.

As regards the capacity of sheet metal roofing in protecting underlying wood from ignition by heat radiated from adjacent fires, it would be easy to get into a theoretical discussion of the relative parts played by reflection, convection, conduction, and reradiation from both inner and outer surfaces. Recent tests of the U. S. Bureau of Standards of sheet metal clad buildings of the garage type indicate that sheet metal gives unusual protection. In one case a sheet steel wall was placed two feet from the garage being tested. Oil-soaked waste hung on the inside of this sheet steel wall did not even smoulder. This would indicate that sheet metal has a relatively high value in protecting underlying wood from ignition temperatures.

Another element entering into the sum total of the influence of roofing on farmstead fire hazards is the extent, if any, to which a roof can confine a fire, regardless of its

(Continued on page 419)



(Left) Ruins of small home at Bozeman, Maryland, struck by lightning and burned to the ground without damage to the metal-roofed building immediately to the rear. (Right) Airplane view at Hampstead, Maryland. Fire originating from lightning in one building spread to others, but did not pass the two metal-roofed buildings in the middle of the picture

Research in Agricultural Engineering

A department conducted by the Research Committee of the American Society of Agricultural Engineers

The Soil Dynamics Problem

By E. G. McKibben

Assoc. Mem. A.S.A.E. Junior Agricultural Engineer, University of California

IN UNDERTAKING the solution of the soil dynamics problem the first step should be a study or at least a review of those factors both past and present which make the soil what it is, and of the resultant properties which affect its utilization in agriculture. As indicated in the following outline this is a very complex study.

I. Natural soil is the result of
   - A. Geologic combinations (parent material)
   - B. Climate
   - C. Natural cover (vegetation)
   - D. Time (that "B" and "C" have been acting on "A".)

II. Agricultural soil (the soil in any certain agricultural field on any certain day) is the result of the above plus
   - A. Amendments (lime, sulphur, fertilizers, etc.)
   - B. Crops grown
   - C. Weather (precipitation, temperature, etc.)
   - D. Tillage
   - E. Irrigation or drainage

In fact the soil situation is more complex than it might appear at first consideration. If there were just two forms of each of the above nine factors, the possible resulting soil conditions would be 2^9 or 512. If there were ten forms of each of the nine factors there would be 10^9, or 1,000,000,000 conditions of soil. Since, the possible variations of several of the above factors, such as parent material, are almost unlimited, the possible number of soil conditions approaches infinity. Thus when the actual complexity of the problem and the relative youth of the soil science movement are considered, it is surprising that the progress has been so rapid. A careful consideration of the literature indicates that much is known concerning the soil. However, it also indicates that there is much more to be learned and that there is an urgent need for the coordination and application of that which is known.

III. The condition of the following chemical, physical and biological properties serve to describe a soil thus formed:
   - A. Solid matter
     1. Weathered portion (fine soil)
        - (a) Elements—(kinds and per cent of each)
        - (b) Inorganic compounds (kinds and per cent of each)
        - (c) Organic compounds (kinds and per cent of each)
        - (d) Organisms (kind and per cent of each)
        - (e) Texture (size of particles)
        - (f) Shape of particles
        - (g) Structure (arrangement of particles)
        - (h) Size, shape and arrangement of the aggregate (clods)
     2. Unweathered or slightly weathered portion
        - (a) Inorganic matter (gravel or larger)
        - (b) Organic (cover crop and undecayed buried material)
   - B. Liquid portion (soil solution)
     1. Solvent (per cent of H_2O)
        - (a) On basis of dry weight
        - (b) On basis of total volume
        - (c) On basis of void space filled
     2. Solute (kinds and per cent of each)
   - C. Temperature of Soil.

Certain of the above properties such as the chemical elements present, per cent of water present, and temperature can be rather satisfactorily determined. On the other hand, it has so far been impossible to definitely measure certain of the above properties as they actually exist in the soil. For example, there is no method available for determining definitely all phases of the texture and structure of the soil, or of the soil solution.

IV. Certain composite physical properties, or soil constants, result from any given combination of the above Chemical, Physical and Biological Properties
   - A. Moisture coefficients
   - B. Specific gravity
   - C. Volume weight

In many cases it has been necessary to attempt to make comparative determinations of certain properties listed in (III) by comparing the composite properties listed under (IV).

V. A definite atomic and molecular attraction complex results from any given combination and arrangement of the chemical, physical and biological properties listed in (III). This complex produces a definite condition of those properties described by the physicist as
   - A. Cohesion (attraction between like molecules)
   - B. Adhesion (attraction between unlike molecules)

VI. Certain working or shaping characteristics are the result of (V)
   - A. Degree of plasticity (relative of elastic limit and point of rupture)
   - B. Degree of hardness (relative resistance to permanent deformation)
   - C. These characteristics, in the case of most materials, are tested for by emperical methods, and expressly by an arbitrary scale.

VII. Certain relatively simple mechanical properties are also the result of (V)
   - A. Tensile strength (tenacity)
   - B. Compressive strength
   - C. Shearing strength
   - D. Friction Coefficients
   - E. Modulus of elasticity
   - F. These mechanical properties may be determined by more or less standardized tests based on mathematical principles.

VIII. Certain composite mechanical properties are also the result of (V)
   - A. Resistance to penetration
   - B. Bearing strength
   - C. Tillage resistance characteristic
   - D. Tractive characteristic
   - E. Tests for these have been and probably will remain emperical in nature.

With the preceding outline as a background, the soil dynamics situation may be divided into three major problems:

1. The determination of those dynamic properties of soils affecting their drainage, irrigation, tillage, traction and use as a foundation and building material. The determination of the effect of changing chemical, physical and biological conditions upon these dynamic properties. The development of standard methods of making absolute and comparative measurements of these dynamic

properties. The solution of this problem will require the cooperation of two groups of specialists:

(a) Soil specialists, that is, soil chemists, physicists and bacteriologists

(b) Agricultural engineers, that is, farm drainage, irrigation, machinery, power and building engineers

2. Determination of what should be done to the soil and when it should be done. The following are examples:

What should be the moisture content of various layers of the soil at various seasons?

What type of manipulation (tillage) should the soil be subjected to at various seasons of the year? (Not a statement that the soil should be plowed, disked, or subsoiled, but that a certain layer should be inverted and loosened in structure, a certain layer mixed and loosened in structure without inverting, or a certain layer should be cracked and loosened in structure without either inverting or mixing.)

What soil amendments should be added; and where (what soil layer) and when should they be added?

Upon what soil conditions is tractive power required?

Again the solution requires the cooperation of two groups of specialists:

(a) Botanists, that is, agronomists, horticulturalists, etc.

(b) Soil specialists, that is, soil physicists, chemists, and bacteriologists.

3. Determination of the best methods and machines for accomplishing those results which the solution of Problem 2 has indicated as desirable. This includes the suggestion of new methods and the design of new machines and a complete mathematical and field test analysis of the dynamics and economics of existing and proposed methods and machines. Once Problems 1 and 2 have been solved, this last problem is primarily that of a single group of specialists:

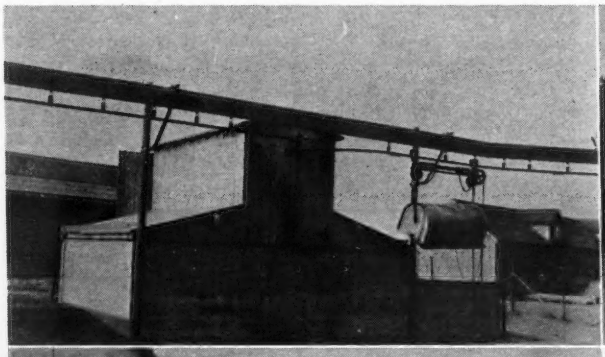
(a) Agricultural engineers, that is, farm drainage, irrigation, machinery, power and building engineers.

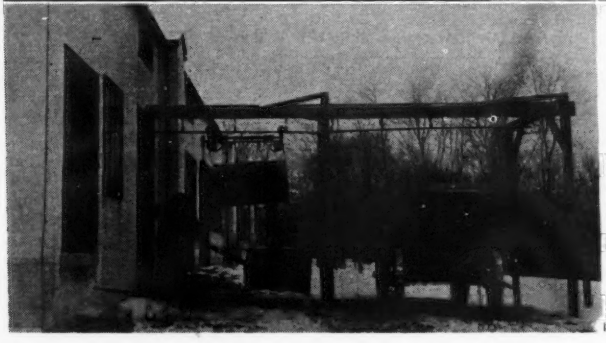
While a certain amount of progress may be made toward the solution of any one of the above problems without a consideration of the other two, it is evident that a complete and satisfactory solution of any one will require the concurrent solution of the other two. Thus a concerted and cooperative attack by all the specialists involved should be the first step in any attempt to solve any of the soil problems.

As a definite example of the unsettled state of the soil situation, consider the matter of the state of tilth of a soil. To begin with there is no recognized definition of tilth, although it might be defined as the state of those properties of the soil which are directly affected by mechanical manipulation (tillage). Those properties directly affected by tillage are size, shape, arrangement, and location of the aggregates (clods) and organic materials; and to some extent the structure or arrangement of soil grains or particles within the clods. Of course, it is evident that all the chemical, physical and biological properties listed under Section III of the above outline are indirectly affected by the state of tilth of the soil. However, even though we are willing to accept this or some similar definition of tilth, the fact still remains that out of the thousands of scientists and farmers working with thousands of varieties of plants and thousands of types of soils, there is not one scientist or farmer who is able to state in definite terms the optimum state of tilth for any one type of soil for any one variety of plant. Surely the time is ripe for the agricultural soil, plant and machinery specialists to do some cooperative work.

(AUTHOR'S NOTE: The author wishes to acknowledge the assistance of Prof. C. F. Shaw and other members of the Division of Soil Technology, University of California, in the selection and arrangement of the material given in Sections I, II and III of the outline.)

(EDITOR'S NOTE: In commenting on the foregoing paper Charles F. Shaw, professor of soils technology, University of California, said, "I hope that it can be published, as I feel it highly desirable that the readers of AGRICULTURAL ENGINEERING should appreciate the complexity of the soil problems and the urgent necessity of cooperative work in solving them.")





The manure pit, shown at the upper left, is completely covered to keep out the flies. The dairy barn in the background has few flies consequently. All liquid manure is caught in the pit at the right. Above is shown the liquid manure spreader being filled from the pit. It pays from two standpoints. It stops fly breeding and it fertilizes the fields. The proper handling, storing and saving of barn manure is important, when manure sells at $6.00 a ton. In handling only the dry manure, as shown in the picture at the left, much of the liquid is lost in gutters and drains

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture

Test of a Wedge Share for a Spring Tooth Cultivator, Martiny (Technik Landw., 6 (1925), No. 12, pp. 21-23, figs. 2).—Tests of a share for a spring tooth cultivator having a flaring wedge shaped cutting edge and a triangular or flat wedge shaped cross section from the edge up to a high point on the shank are briefly reported. This tool was found to almost completely prevent the turning up of the noodle shaped strips, usually turned up by flat shares, in the more plastic soils, owing to its wedge action. A better seedbed is thus obtained. The draft of the wedge share was slightly greater than that of the flat share.

The Home Refrigerator, E. H. Parfitt (Indiana Station Circular 124 (1925), pp. 12, figs. 5).—Experiments on the operation and efficiency of small ice refrigerators are reported.

The results showed that bacterial multiplication in foods in refrigerators varies directly with the refrigerator temperature and that the temperature varies in different parts of the refrigerator, being coldest in the lowest part of the ice chamber and warmest above the ice chamber. The cold air circulates downward, then upward. The temperature was found to be lowest on the shelf directly below the ice chamber and warmest on the top shelf in a refrigerator receiving ice from the side. The temperatures of the different shelves in the food compartment of a refrigerator receiving ice from the top varied very little, and there was less variation in temperature in the food chamber of top-icing refrigerators than in that of refrigerators icing from the side.

The window box was found to be a fair substitute for a refrigerator with reference to temperature during periods when the outside weather conditions vary from a maximum of 60 degrees Fahrenheit to a minimum of 31 degrees.

The amount of ice in the ice chamber of a refrigerator was found to vary indirectly with the refrigerator temperature. The greatest increase in temperature occurred when the ice chamber contained less than one-third the rate capacity of ice.

Covering the ice with newspaper increased the temperature within the refrigerator, and the saving in ice was not sufficient to warrant this increase in temperature. Covering with newspaper also caused a high absorption of volatile odors.

Energy Requirements of Farm Work, K. v. Meyenburg (Technik Landw., 5 (1924), No. 9, pp. 165-171, figs. 3).—Data on the power requirements of agricultural operations in Germany are briefly presented which indicate that under certain conditions mechanical power is cheaper than man or animal power for such uses.

Differentiation of the Action of Acids, Alkali Waters, and Frost on Normal Portland Cement Concrete, C. J. Mackenzie and T. T. Thorvaldson (Engineering Journal [Canada], 9 (1926), No. 2, pp. 79-84, figs. 3).—In a contribution from the University of Saskatchewan a description is given of an actual case where concrete disintegration caused by alkali water, acid water, and frost occurred in one structure in which conditions were such that failure could have been attributed to any one of the three causes. The chemical methods developed and adopted to determine definitely the cause of disintegration in each case are presented.

The Capacity of Irrigation and Drainage Wells, H. E. Murdock (Montana Station Bulletin 182 (1925), pp. 16, figs. 3).—Data are presented to show the behavior of irrigation and drainage wells that are in actual use and giving satisfactory service, and to indicate what may be expected anywhere under similar conditions. The data are for dug irrigation wells with diameters ranging from 2.5 to 16 feet and for drilled wells with diameters ranging from 1 to 2 feet.

The values of the specific capacities for the dug wells were found to vary from 0.037 to 0.39 cubic feet per second per foot of draw-down; that for the drilled wells varied from 0.022 to 1.04. The results indicated that for practical irrigation and drainage wells there is no apparent definite relation between the amount of water a well will yield and its diameter. For a given well there is a definite relation between the yield and the draw-down as shown by the characteristic curve. This relation is expressed quantitatively by the specific capacity. The data do not indicate that in new pumping districts dug wells of large diameter will give a greater yield than drilled wells.

It was found further that the greater the total thickness of the water bearing strata penetrated by a well the larger will be the yield for a given draw-down. It is for this reason that wells of large capacity are frequently drilled several hundred feet deep, although the water table may stand within a few feet of the surface. When wells are drilled where the water bearing-strata are not encountered until the shaft has been sunk rather deep, the water usually rises in the shaft above the point where the water-bearing stratum was first touched.

Building Plans and Bill of Materials for O. A. C. Portable Brooder House, A. G. Lunn (Oregon Station Circular 66 (1926), pp. 8, figs. 8).—Working drawings and a bill of material are presented.

Water and Plumbing Systems for Farm Homes, E. W. Lehmann and F. P. Hanson (Illinois Station Circular 303 (1925), pp. 20, figs. 12).—Practical information on water and plumbing systems for farm homes, with special reference to Illinois conditions, is presented.

Blasters Handbook, A. La Motte (Wilmington: E. I. du Pont de Nemours & Co., 1925, pp. 198, figs. 200).—This handbook describes practical methods of using explosives for various blasting purposes, including, among other things, the clearing of land of stumps and rocks, removing log jams, and various types of construction.

The Furrow Drill for Sowing Winter Wheat in Central Montana, R. W. May and C. McKee (Montana Station Bulletin 177 (1925), pp. 24, figs. 16).—Experiments conducted in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture are reported, which showed that in comparison with the ordinary drill the furrow drill, which plants wheat in furrows, causes a material reduction of winter killing and reduces injury due to the drifting of soil. The furrows and ridges made by the furrow drill were found to be quite effective in reducing soil blowing. Wheat sown in furrows was found to receive more benefit from either light or heavy snows than that sown with an ordinary drill. Light snows drifted into the furrows and filled them to the top of the ridges, thereby protecting the plants, while wheat sown with an ordinary drill was frequently left entirely exposed to weather conditions following light snows. There was less winter injury due to alternate freezing and thawing of wheat sown in furrows than of wheat seeded under the ordinary method. Most of the cracks under the furrow method of seeding occurred along the ridges, while under the ordinary method of seeding they occurred promiscuously throughout the drilled area and killed or injured much of the wheat. Winter wheat sown with a furrow drill was found to have a tendency to emerge earlier than wheat sown with an ordinary drill, due to the more favorable moisture conditions prevailing in the deeper furrow. The winter wheat sown with a furrow also produced greater yields than that sown with an ordinary drill, due to less winter killing.

It was found that there is a slight disadavantage in sowing spring wheat with a furrow drill as compared to sowing with the ordinary drill. The ridges made by the furrow drill interfered more at harvest time. Straw mulching did not consistently decrease or increase the stands in spring or the yields obtained from using either drill during the four-year period 1920-1923. On the whole, the straw mulch appeared to injure slightly the spring stands and reduce the yields obtained from spring wheat sown with the furrow drill, while slightly better stands and yields were obtained from that sown with the ordinary drill. Suggestions for using the furrow drill are included.

Static Electricity in Stationary Threshers, C. C. Johnson (Washington College Station Bulletin 196 (1925), pp. 11, 12).—It is stated that a continuation of this work has shown that the static electricity in stationary threshers occurs between the straw and the machine rather than between the parts of the machine, and that the problem is rather to neutralize the static in the body of the machine than to ground the machine. There appears to be some relation between static conditions and humidity which may point to a means of controlling smut explosions.

Permeability of Stone, D. W. Kessler (U. S. Department of Commerce, Bureau of Standards Technology Paper 305 (1926), pp. 155-172, pls. 2, figs. 3).—This paper describes an apparatus for measuring the permeability of stones and concretes, and presents the results of a limited number of tests of six types of natural stone to determine the adaptability of the apparatus to a considerable range in textures. Experiments on the value of a penetrating waterproofing material on marble indicated that the permeability of this material can be reduced 98 per cent by this means. The tests in general indicated that the relation of permeability to the pressure is approximately a straight-line ratio. A comparison of the permeability of specimens of different thicknesses indicated that by doubling the thickness the permeability was reduced approximately one-third.

Brick Making on the Farm, A. C. Jennings (Rhodesia Agricultural Journal, 23 (1926), No. 1, pp. 21-28, pl. 1, figs. 2).—Methods and apparatus used in the manufacture of bricks on Rhodesian farms are dsecribed.

A Study of Temperature in High-Alumina Cement and Methods of Curing, H. S. Mattimore (American Society Testing Materials Proceedings, 25 (1925), pt. 2, pp. 192-197, figs. 2).—Studies conducted by the Pennsylvania State Highway Department are reported which showed that high alumina cement has compressive and transverse

strengths at 24 hours greater than those of Portland cement concrete at 28 days. Wet burlap curing, effective for Portland cement concrete, was found to increase the temperature during hydration and to produce a defective surface when used with high alumina cement concrete.

Application of moisture at too early stages either by sprinkling, ponding, or covering with wet burlap produced a dusty or scaled surface. It is concluded that water curing should be started when hydration is well under way as indicated by a rise in temperature. This can be detected by a stiffening of the surface and a drying out appearance. Under laboratory humidity and temperature conditions the safe period was found to be seven hours after mixing. Storage or air curing in bags reduced the high temperature during hydration and also delayed hydration. After four months storage in bags the hydration was delayed about two hours.

Researches in Concrete, W. K. Hatt (Purdue University, Engineering Experiment Station Bulletin 24 (1925), pp. 102, figs. 31).—Part 1 of this bulletin discloses the sequence and extent of research activities in concrete, Part 2 reviews the status of some of the important fundamental researches in unsettled fields, and Part 3 contains a bibliography of research in selected fields.

The Significance of the Common Test Methods for Determining the Strength of Mortars, J. W. Cowen and H. W. Leavitt (American Society Testing Materials Proceedings, 25 (1925), pt. 2, pp. 218-227, figs. 6).—Studies conducted by the Maine experiment station and the Maine State Highway Commission are reported.

It is concluded that the standard tension test, the standard compression test, and the new abrasion test upon sand mortars give quantitative measures of important stresses to which a mortar is subject in many concrete structures. Each of these tests gives concordant results when check tests are performed upon the same materials. It is further concluded that each of these tests should be performed upon all sands to be used in Portland cement concrete.

The Fire Resistance of Gypsum Partitions, S. H. Ingberg (American Society Testing Materials Proceedings, 25 (1925), pt. 2, pp. 299-314).—Tests conducted at the U. S. Bureau of Standards are reported which showed that gypsum block construction of proper material and thickness gave performance indicating good ability to stop or retard fires in buildings as used in nonbearing partitions not subject to heavy impacts. The temperatures transmitted to the unexposed side were in no case excessive, and there was no pronounced bulging or cracking of the partition. The gypsum on the fire side dehydrated and became weak and crumbly. Plaster that remained in place during the fire exposure was found to add considerably to the resistance of the partition, and indicated the desirability of the present practice of scoring the surface of the blocks to give a key for the plaster.

Influence of Electric Cooking on the Load Condition of Power Systems, C. Hassler (Elektrotech. Ztschr., 44 (1923), No. 23, pp. 542, 543, figs. 4).—The effect of electric cooking on the load conditions in the various parts of an electrical supply system, including the power station, feeders, and consumers' circuits, is analyzed, and load curves and numerical data are given from a network in the neighborhood of Stockholm, Sweden, which operates at 220 volts direct current with underground feeders and overhead distributors. A restricted hour tariff is employed and the supplies for cooking and lighting are metered separately. The annual consumption for lighting averages 190-kilowatt-hours per consumer and for cooking 1,750 kilowatt-hours per household. About 20 per cent of the total consumption for cooking falls within the period of the lighting peak. The cooking load falls off rapidly after 5 p.m. and does not seriously increase the evening peak. With the double tariff in force electric cooking is responsible for 0.44 kilowatt maximum demand per connected consumer using current for cooking, this demand occurring between 3 and 10 p.m. during the winter months. The double tariff transfers the combined cooking and lighting peak to the morning hours when about one-third of the lighting consumers use electric cooking. The addition of the cooking load is felt most in the distribution mains.

It is considered good policy to supply cooking loads at cost. A thermal storage oven for a family of four or five persons consumes from 350 to 500 watts continuously and has an effect on the load curve quite different from that of an ordinary direct heating oven. The thermal storage oven should preferably be switched out of circuit automatically during the lighting peak.

High-Alumina Hydraulic Cements, P. H. Bates (Industrial and Engineering Chemistry, Washington, D. C., 18 (1926), No. 6, pp. 554-559, figs. 5).—In a contribution from the U. S. Bureau of Standards the composition and properties of high alumina cement, especially as compared with Portland cement, are described, and its commercial uses are pointed out. This cement has a high strength and resistance to sulfate-bearing water, and attains the same strength in twenty-four hours that ordinary cements acquire in twenty-eight days.

A Photometric Method for Measuring the Hiding Power of Paints, H. D. Bruce (U. S. Department of Commerce, Bureau of Standards Technological Paper 306 (1926), pp. 173-190, pls. 2, figs. 6).—The results of an investigation to develop a method for measuring the hiding power of paints from dry films are reported. A photometric method was evolved in which the contrast is measured between the two shades of a black and white plate showing through a thin overlying coating of paint. The degree of this contrast is a function of the film thickness and the hiding power of the paint. The hiding thickness is computed from the formula $x = 7a \sqrt{\frac{1}{b} - 1}$, in which x is the hiding thickness, a is the measured film thickness, and b is the measured contrast ratio. The hiding power in square feet per gallon is then calculated from the formula, hiding power$= \frac{0.4075\ (100\text{—per cent of volatile})}{\text{hiding thickness in mm.}}$.

Some Observations on Sewage Tank Gases, A. M. Buswell and S. I. Strickhouser (Industrial and Engineering Chemistry, Washington, D. C., 18 (1926), No. 4, pp. 407-409).—The results of studies conducted by the Illinois state water survey division are reported which show that gases from foaming Imhoff tanks contain more carbon dioxide, less nitrogen, and substantially the same amount of methane as gases from nonfoaming tanks. It is thought that the amount and heating values of gas available from Imhoff tanks are sufficient to warrant its collection and use for fuel purposes.

Lubrication of Plain Bearings, D. P. Barnard, IV (Journal Society of Automotive Engineers, New York, 18 (1926), No. 5, pp. 483-485, figs. 2).—Studies are briefly reported of the behavior of oil after it has reached a bearing. A visual study was made by means of a glass bearing, and the results were reproduced by a film, the action of the lubricant being made visible by introducing into the oil a small quantity of dyed glycerine solution of about the same viscosity as the oil.

In one case the operating conditions were such that a relatively thick supporting film was formed and the oil followed closely the direction of journal rotation. In another case, however, the conditions were altered to allow the film to thin out to a marked degree. In this case the oil was forced more rapidly toward the ends of the bearing. This study also showed, in a striking manner, the effect of moving the oil hole to the loaded side of the bearing in actually allowing the bearing to suck in air at the ends and to displace the oil backward along the feed tube. With such an arrangement it would be necessary to provide a very high feed pressure to insure the proper flow of oil.

Antiknock Materials, W. H. Charch, E. Mack, Jr., and C. E. Boord (Abstract in Industrial and Engineering Chemistry, Washington, D. C., 18 (1926), No. 4, pp. 334-340, figs. 7).—Studies conducted at Ohio State University on antiknock materials are reported.

Nickel as the carbonyl was found to have antiknock coefficient of 30; bismuth in its trialkyl and triaryl derivatives possessed a coefficient of from 18.2 to 20.2; and cadmium in its alkyl compounds and titanium as the tetrachloride were also found to function, but in a less marked degree. It was found that the state of valence of the antiknock element is not essential in determining which of its compounds should function.

Experiments on suppression of detonation in an open tube led to the conclusion that an attempt to apply the results obtained with the detonation tube to a study or an explanation of the suppression of the fuel knock in a motor is unjustified.

Studies on the electrical conductivity of the cylinder gases as a function of detonation showed that gaseous ionization decreases with decreasing detonation in internal-combustion engines. This decrease is noted irrespective of whether the knock is suppressed by the addition of an antiknock compound or by changing the composition of the fuel. This is taken to indicate that antiknock materials affect this ionization only in so far as they tend to suppress detonation.

A chemical theory of antiknock materials and their action in suppressing detonation is presented.

Automatic Feed Grinding with Motors, J. B. Davidson, Iowa Agricultural College Official Publication, Ames, 24 (1926), No. 32, pp. 4-6, fig. 1).—Experiments conducted at the Iowa experiment station on feed grinding with electric motors are briefly reported.

The results indicated that a small motor can be used for feed grinding, that time control is practicable, and that quantity control is easily arranged. The small grinder was found to have as high an efficiency as larger grinders, and the use of magazine bins save labor.

Ridge Cultivation in Lower Gujarat, B. M. Desai and K. B. Naik (Bombay Department of Agriculture Bulletin 123 (1925), pp. 30, pls. 8).—A new method of cultivation is described, and the results of experiments in its application to the black soil tracts in lower Gujarat are presented. In this method crops are grown on ridges and not on the flat, and with judicious cultivation between the ridges the yield of cotton can be raised either in wet, dry, or normal years by an average of from 23 to 25 per cent and that of sorghum by an average of over 23 per cent of grain and from 5 to 10 per cent of fodder.

The experiments showed that ridge cultivation affords good surface drainage and prevents the land from becoming partially waterlogged in the upper eight or ten inches during the period of heavy rain. The amount of weeding in ridged plats was found to be considerably less than on the flat. The experiments were made on fairly clean fields, however. The root developments of both cotton and sorghum were deeper on the ridged plats. The ridge system of cultivation was found to permit late intertillage. It was found that in the early stages of growth the crop on ridges remains green while that on the flat becomes yellow during heavy rain. It was possible to work the soil on the ridges after heavy rains much earlier than on the flat.

AGRICULTURAL ENGINEERING

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RAYMOND OLNEY, Editor

Business Practices Applied to Farming

FOR the last four years I have watched the growth of a very special type of farm business. The farm is operated by two railroad companies as a phase of the development of their land grants, and its particular business is to produce cauliflower at a profit. The companies dislike very much to see the story of their operations written in red figures.

Cauliflower is a sensitive crop and expensive to grow. It does not thrive unless the soil is in good physical condition and has a large amount of available fertility. Much hand work is required on account of the nature of the plant and market requirements. It is grown here because soil and climatic condition are exceptionally favorable and it is more profitable than most other crops.

The following business practices observed in the management of this farm seem necessary to its success and probably should be applied more generally.

Production is based on the carload lot. This gives the double advantage of lower transportation costs and choice of markets, therefore better price. The product is marketed at wholesale through a commission house and has no advantage over a private trade.

The planting of the crop is carefully scheduled to secure even distribution of the harvest over a long season. This avoids periods of rush work with consequent heavy expense and reduces risk of loss on a bad market.

An effort is made constantly to find out and adopt the best growing practices in order to increase both the amount and quality of the yield. Chemical fertilizers enough are used to replace the amounts removed by the crop and green crops are plowed under to improve the physical condition of the soil. The stored up plant food is not exhausted to show a temporary profit.

An accurate cost account is kept and studied for the purpose of keeping the cost of production below the average market returns. Payrolls and material requisitions are distributed to the various operations and overhead enough is charged to cover supervision, depreciation and the like, so that the cost sheets show as nearly as possible the true charges against the various operations of the project. When it can be shown that an improved machine or method will permanently reduce costs, the change is made.

The railroads of the country have increased their net income from next to nothing, when they were released from federal control at the end of the war, to an amount sufficient now to pay modest dividends. They have done this through improved service which moves a ton of freight more quickly, safely and at less cost than ever before. The problem of the two railroad companies in this farm experiment has been to produce a superior quality of cauliflower and put it on the market for a cost per crate low enough to compete with any other section of the country. This result has been secured by careful planning and organization of the business along the lines discussed above, as well as by good equipment and loyal, intelligent work on the farm. I agree with Mr. Huntington's statement in the September issue of AGRICULTURAL ENGINEERING that agriculture needs to be engineered, but would include as part of the engineer's work the organization of the business.

WALLACE ASHBY

The New Agriculture*

PROFIT—rather than price—is this to be the new slogan of Agriculture?

J. W. Coverdale, for several years executive secretary of the American Farm Bureau Federation and today an outstanding man in Middle West Agriculture, is a proponent of this idea. Another is Arthur Huntington** of Cedar Rapids, Iowa. Today, Coverdale's ideas of efficiency are exemplified in the crusade he is carrying on toward the elimination of needless duplication in elevators in the small towns of Iowa. Huntington has preached and written the gospel of industrialization and electrification of the farm.

"Dollar corn is no longer the slogan," Coverdale points out. "The producer is now thinking of corn that can be sold for more than the cost of production. He now sees that he must not only get a large return per acre, but a higher return per worker. That he must have efficient production equipment and learn to use it efficiently. Average results are not his aim; if he is to succeed, his practices must be the best in the industry.

"In the past, practically the only thing considered as a barometer of agricultural conditions has been 'Price.' A high price has been accepted as prosperity, and a low price as calamity."

Mr. Coverdale, however, defines the correct price of a product as that price which will move the entire crop into consumption without a shortage or carry-over; and provide a profit for the producer.

The first step in cooperative merchandising is the practice of self-restraint on the part of those who would cooperate, claims Coverdale, who also points out that the farmer cannot have both public aid and all his personal liberties at one and the same time. Neither can producers who want to cooperate with others do so unless they are willing to forego their personal liberties for the sake of the cooperation.

*An editorial reprinted from the November 20, 1926, issue of "The Dearborn Independent."

**Mem. A.S.A.E. Chairman A.S.A.E. Rural Electric Division.

The Value of Meetings

ONE of the most effective means of bringing the American Society of Agricultural Engineers, its aims and activities, into public recognition is through the location and publicity of its meetings. The sectional organizations have done much, judging from past meetings of A.S.A.E. sections, to spread the gospel to the general public within its boundaries. Commercial interest is especially attracted to the sectional meetings, whereas the national meeting might appear impractical to the localized business. Nevertheless, there is nothing of a local nature which can carry the prestige of a national meeting. The West will testify to the publicity enjoyed by the American Society of Agricultural Engineers along the Pacific Coast due to the June meeting. For the benefit of the great body of members and to put the Society before the eyes of the general public there must be national meetings in every section of the country.

D. B. LUCAS

A. S. A. E. and Related Activities

Southern Section Meets in February

THE first meeting of the recently organized Southern Section of the American Society of Agricultural Engineers will be held at Atlanta, Georgia, February 2, 3, and 4. It is scheduled to be held at the same time and place as the annual meeting of the Southern Agricultural Workers Association. In its program of that meeting the S.A.W.A. has chosen to feature as its central topic the elimination of waste in agriculture. This subject will also be featured in connection with the meeting of the Southern Section, particularly the agricultural engineering features of waste in agriculture.

Minnesota to Have Student Branch

AN ORGANIZATION meeting was held at the University of Minnesota November 17 to take preliminary steps in the organization of a student branch of the American Society of Agricultural Engineers at that institution. Fourteen students attended and signed the petition as charter members, which will be presented to the Council of the Society. A committee was appointed to draft the constitution and by-laws to conform to university regulations and to the requirements of the Society. Officers were elected and the students listened with a great deal of interest to talks given by members of the agricultural engineering staff.

Mr. Louden Honored

WILLIAM LOUDEN, of the Louden Machinery Company, one of the few honorary members of the American Society of Agricultural Engineers, celebrated his eighty-fifth birthday on October 15. He was honored on this occasion by the Rotary Club of Fairfield, Iowa, of which is a member, and in recognition of his service to the farm-equipment industry Mr. Louden was on this occasion presented with a gold-headed cane. Mr. Louden made a short response, in which he gave a graphic account of his early struggles in the farm equipment business and paid a high tribute to Mrs. Louden to whom he gave much of the credit for his success.

Rural Electrification in Kansas

BEARING the title "The Kansas Rural Electrical Laboratory" the Kansas Committee on the Relation of Electricity to Agriculture has issued a bulletin describing the uses of electricity on the farms in Pawnee County, constituting the Kansas rural electrical laboratory, which represents, for the most part, practical farm applications where central station service is available. H. B. Walker is state supervisor of the Kansas rural electrification project, and H. S. Henrichs is field engineer.

Administrative Board of American Engineering Council Meets

MEETING at Cornell University with its president, Dean Dexter S. Kimball, November 11 to 12, the Administrative Board of American Engineering Council weighed several of the outstanding national engineering problems. Important among its actions were decisions to assist in minimizing the volume of corporate reports, to assist in the Hoover plan for the devolpment of a national policy for water resources, to sponsor a standardization program for street and highway safety signals, to continue its prosecution of the effort to secure a federal department of public works and domain, to make further study of the proposed standard state mechanics lien act, to regularize patent procedure and urge a more adequate patent office building.

In recognizing the burden and high cost annually saddled upon industry by demand for data for the federal and state governments, the Board took its first step in cooperating with the National Association of Manufacturers and other bodies to minimize this waste. Plans were also laid for suitable coordination and simplification of these data and reports so that the data collected could be used by all governmental agencies and be made available in a larger way to outside organizations. Reports to the Board brought out the fact that though much data had been assembled for special purposes, it was seldom useful in other studies even though they might be related to the original subject for which the data were gathered.

Endorsement of the plan of Secretary Hoover for a national policy in the development of the water resources of the country was enthusiastically given, together with a pledge of the active support of the Council in carrying out this plan. The Secretary's plan includes more extensive development of inland waterway transportation, irrigation, reclamation, flood control, power, and a suitable federal organization to handle all of this work. The plans of Secretary Hoover harmonize closely with three pieces of national legislation now being endorsed by American Engineering Council, namely, the bill proposing an inventory of the water resources of the country, the bill which would establish a national hydraulic laboratory, and the federal department of public works bill.

As an outgrowth of American Engineering Council's work in the national conference on street and highway safety, a special committee on street signs, signals and markings was authorized and directed to secure the necessary funds in cooperation with other interested organizations so that it may prosecute a nation-wide study of the whole problem. Determination of the present practices relating to size, shape, color, illumination and location will be involved. The relative merits of manual or automatic methods, location of signs, etc., will be included. The appointment of a committee of engineers who have been prominent in this field was authorized to carry on the work.

The report of a committee of organization experts who have been making a special study of a suitable internal organization for the proposed department of public works was adopted insofar as it had been completed. The study, which has been in progress for over a year, has covered all of the engineering and public domain functions of the federal government and resulted in recommendations that the following offices be included in the proposed department: From the Department of the Interior—geological survey, bureau of reclamation, the Alaska railroad, national park service, general land office; from the Department of Agriculture—the bureau of public roads; from the War Department—board of road commissioners for Alaska, Alaska telegraph and cable system, Northern and Northwestern lakes survey, and the non-military river and harbor work of the office of chief of engineers, board of engineers for rivers and harbors, Mississippi River commission, California debris commission, and supervisor of the harbor of New York; from the Treasury Department—the office of the supervising architect; also the following independent offices, commissions, etc.—federal power commission, office of public buildings and public parks of the national capital, departmental services for maintenance and operation of buildings, and the office of the architect of the capitol. The layout for the new department will be completed and submitted as a part of this report.

The Administrative Board went on record as being definitely opposed to the extension of the time limitation on patents and the enactment of any special patent legislation for the benefit of individuals. Those in charge of the present buildings program for the federal government were urged to provide better housing facilities for the United States Patent Office out of the $50,000,000 appropriation available for federal government buildings in the District of Columbia.

The general subject of compensation of professional engineers was widely discussed as the result of a report to the Board. This report stated that because of the major purpose of American Engineering Council to "support movements affecting public welfare when from an economic viewpoint such movements are believed to be worthy of support," it was the opinion of Council's Committee on Compensation of Engineers that Council should not enter into the field of discussion as to the compensation which professional engineers should receive. According to the report, the "solution is wholly an internal problem of the profession calling for no publicity but self-examination and criticism."

A further study of the standard state mechanics lien act, which was developed under the auspices of the Department of Commerce, will be made by a special committee of Council appointed for that purpose.

A cordial welcome was extended to the Board by Dr. Livingston Farrand, president of Cornell University, and Dean Kimball, president of American Engineering Council. The next meeting of the Board will be in conjunction with the annual meeting of American Engineering Council, to be held in Washington, D. C., January 13 to 15, 1927, at The Mayflower.

Govenment Survey Helps Land Owners

THE United States Coast and Geodetic Survey, in a recently issued pamphlet emphasizes the value of using accurate government-compiled information in making surveys of farms and other properties. It is pointed out that the land owner who desires to be absolutely sure of the permanence of the boundary lines of his property should connect its survey with one of the government survey markers which are located throughout the country and tied together in a country-wide system. The publication of the Coast and Geodetic Survey says, in part:

"Accurate measurement across country by means of a measured line and the observed angles of a connected series of triangles is called triangulation. The triangulation of the Coast and Geodetic Survey, in addition to its use in locating international and state boundaries, and in locating points for the control of general maps, is also useful in establishing boundaries of farms and smaller parcels of land where permanent reference points are important.

"When this country was first settled, land values were so low that surveyors in laying out boundaries of private and public lands, did not need to exercise the care involved today. Nowadays, the boundary must in some cases, especially in cities, be located within a fraction of an inch and, where land values are less, the uncertainty of a foot in the location of the boundary is a serious matter.

"Originally, no geometrical scheme was followed in the surveys of farms in the United States. The compass was used to get the directions of the boundary and in few cases only were the turns in the boundary lines properly marked by objects which would remain undisturbed for a generation or more. The boundary frequently started from a stump, tree, or boulder, or at the intersection of two roads. All these things are subject to change by the processes of nature or the works of man.

"The triangulation stations of the Coast and Geodetic Survey are valuable in the perpetuation of the positions of the turns in the farm boundary. If the boundary survey of a farm or other parcel of land were tied in, by direction and distance, to one of these stations, the boundary lines could always be reproduced in their true position within the limits of accuracy of ordinary surveying methods, even though all the reference marks at the edge of the property should be destroyed.

"The triangulation stations are marked in a substantial way and bronze tablets are used, making for added permanence. Yet, even though all the station markers in any given region were destroyed, it would still be a simple matter to locate any station again within a few inches by making observations from nearby stations.

"There is only one point on the earth which has a particular latitude and longitude. Therefore, each triangulation station has a definite position on the face of the earth because its latitude and longitude are a matter of record in the office of the Coast and Geodetic Survey in Washington.

"Engineers in cities are beginning to realize that the old method of laying out parcels of land, each connected with one or more separate reference points, has been very unsatisfactory. Frequently the reference points are known only to the engineer who made the original survey and data regarding them are not available to the general public.

"If city lots are referred to a single coordinate system such as the triangulation of the Coast and Geodetic Survey however, the corners of a lot may be located with reference to any one of a number of the control stations of the city survey. As land becomes more valuable in large centers of population, it is certain the single system must be put into effect.

"The Coast and Geodetic Survey has established a system of triangulation stations all over the United States and more stations are being added yearly. Reports are published giving the description of each station, how it is marked, its latitude and longitude, and the true bearing and length of the lines joining adjacent stations. This wealth of data should be used in connection with surveys of private property. Each report, as a rule, covers a single state and may be of private property. Each report, as a rule, covers a single state and may be purchased from the Superintendent of Documents, Washington, D. C., at small cost, usually from ten to twenty-five cents.

"The true bearings of all the lines of the triangulation, including lines to church spires, cupolas, smokestacks, etc., enable the local surveyor to easily test his compass and obtain its variation from true north, in retracing property lines.

"Unfortunately, the Coast and Geodetic Survey has no means of preventing destruction of markers left at triangulation stations, although several States have passed laws making it a criminal offense to destroy a government surveying monument. It is to the interest of both the local surveyor and the property owner to create public sentiment in favor of protecting the markers of government triangulation stations against thoughtless or malicious interference or destruction. Local surveyors will be performing a public service by informing the Director, Coast and Geodetic Survey, Washington, D. C., as to the present condition of any triangulation stations they may visit."

Protection Against Forest Fires

IN CONNECTION with the observation of National Fire Prevention Week early in October, various interests in the Pacific Northwest, including the Western Forestry and Conservation Association and the National Lumber Manufacturers' Association, together with bankers and business men, sent a delegation to Washington to wait on President Coolidge and General Lord with a view to securing their approval for a more adequate program of fire prevention in the national forests, and the necessary appropriation therefor.

It appears that during the preceding year there were 7,408 forest fires in California, Oregon, Washington, Idaho, and Montana. According to rough estimates by the United States Forest Service, 745,000 acres were burned over and 906,000,000 board feet of merchantable timber valued at something like $3,500,000.00 was destroyed. Besides this is the loss due to destruction of new growth, seedlings, saplings, etc., on some 1,200,000 acres of potential forest land, a loss not easily reduced to figures but obviously very great. Notwithstanding the extent of these losses, they are regarded as comparatively light, thanks to good fortune and the efficiency of the fire fighters. It is stated that the losses were about four times as great in government forests as in private timber, and it is implied that this is due to inadequate financing of the federal fire prevention program. Another interesting point is that tourists and campers have been educated, or intimidated, to such an extent that they cause fewer forest fires than the inhabitants. However, the outstanding cause of forest fires, at least in the area mentioned, is lightning, which thus far has not proved amenable either to education or legislation.

According to the interests demanding a more extensive fire prevention program, the maximum practical degree of protection would require an annual expenditure of about three

cents an acre for all the forest land in the United States, a total of some $13,000,000.00 which may be compared with the present expenditure of $3,000,000.00 to $5,000,000.00.

The Place of Metal Roofs in the Reduction of Farm Fire Hazards

(Continued from page 411)

origin, to the building in which it starts and reduce the hazard to adjacent buildings. In this respect sheet steel and iron are in a class by themselves. Not only are they completely incombustible, but they are infusible, non-fragile, and capable of retaining to a considerable degree their mechanical strength at the highest temperatures encountered in an ordinary building fire. As contrasted with the shower of sparks and embers and the increased intensity of burning which commonly occur when a combustible roof collapses, a sheet metal roof, particularly if of the locked seam type, tends to hold together and act as a blanket both before and after it falls, a characteristic shared in similar degree by no other practicable building material.

In conclusion it may be said that the combination of lightning protection, spark or ember resistance, resistance to radiant heat, and a relatively high ability to resist the spread of fire within should be given due weight, together with other characteristics going to make up the desirability of a roofing material, by agricultural engineers when their advice is sought as to roofing practice.

(EDITOR'S NOTE: A nation-wide investigation is being made to discover if there has ever been a case of lightning striking a building having a sheet metal roof, properly grounded, in which the building or contents were damaged. If such cases are on record, readers of AGRICULTURAL ENGINEERING are urged to report them to the editor.)

Personals of A.S.A.E. Members

W. T. Ackerman, engineer, New England Rural Electrification Project, New Hamshire Agricultural Experiment Station, has collaborated with F. A. Westbrook, engineering editor of "Electrical Record," in the preparation of an article appearing in that publication, describing the scope, additions, and some of the results of the study in New Hampshire of the problems of electricity as applied to farming.

Deane G. Carter, professor of agricultural engineering of the University of Arkansas, and chairman of A.S.A.E. Farm Structures Division, delivered two addresses before the convention of the National Association of Mutual Insurance Companies and the Federation of Mutual Fire Insurance Companies held at Louisville, Kentucky, October 11 to 14. The title of his first address was "The Insurance Company and the Agricultural Engineer;" the second address was entitled "Loss Prevention Through Construction." Both addresses were very well received.

J. T. McAlister, associate professor in charge of agricultural engineering, Clemson College, South Carolina, was a moving spirit in the conduct of a highly successful farm power and machinery day at the college, September 23. Nearly four hundred farmers who attended displayed keen interest in several makes and types of tractors and other modern farm machinery, and from addresses and informal questioning acquired a great deal of practical information both from members of the staff of the college farm, instructional and extension staff, and from representatives of farm equipment manufacturers. Among those who contributed to the interest of the occasion was Wade Drake, who this season harvested a crop of oats yielding 128 bushels per acre, believed to be a world record.

E. R. Raney has resigned as associate professor of agricultural engineering at the A. & M. College of Texas to become agricultural engineer for the J. C. Penney-Gwynn Institute of Applied Agriculture at Green Cove Springs, Florida. Mr. Raney will have charge of the agricultural engineering phase of the development on a 120,000-acre project, of which 20,000 acres have already been developed into 20-acre farms.

A. J. Schwantes, assistant professor of agricultural engineering, University of Minnesota, is author of Special Bulletin No. 110, "The Use of Explosives on the Farm," just issued by the agricultural extension division of the University of Minnesota.

New A.S.A.E. Members

W. C. Blackwood, professor of physics, Ontario Agricultural College, Guelph, Ontario, Canada.

Pierre Blommers, manager of ventilator sales, H. H. Robertson Co., First National Bank Bldg., Pittsburgh, Pa.

F. L. Budgett, rural service division, Adirondack Power & Light Corporation, Schenectady, N. Y.

John Goddard, foreman, in charge of experimental work, Frost & Wood Co., Ltd., Smiths Falls, Ontario, Canada.

H. M. Harter, consulting agricultural engineer, Stockton, Cal.

W. H. Holmes, irrigation engineer, Modesto Irrigation District, Modesto, Cal.

Miles Horst, farmer-editor, Stockman-Farmer Publishing Co., Pittsburgh, Penn.

Ethel G. Klopping, demonstrator of electric stoves, Municipal Electric Light & Power Plant, Richmond, Ind.

Alfred Krieg, chief engineer, Nichols & Shepard Co., Battle Creek, Mich.

Miriam Rapp, home economics department, Purdue University, Lafayette, Ind.

F. W. Small, field engineer, Portland Cement Association, Somerville, Mass.

Charles Volhert, contractor, farm water supply and well construction, South Manchester, Conn.

J. S. Witmer, assistant general sales manager, J. I. Case Threshing Machine Co., Racine, Wis.

Transfer of Grade

J. Grant Dent, instructor in agricultural engineering, University Farm, St. Paul, Minn.

A. D. Edgar, instructor in farm mechanics, Menominee Agricultural School, Menominee, Mich.

L. H. Ford, state tractor short-course instructor, State Department of Vocational Education, Greenfield, Ill.

W. J. Godtel, J. I. Case Threshing Machine Co., Racine, Wis.

W. D. Hemker, general engineering, Westinghouse Electric & Mfg. Co., East Pittsburgh, Penn.

H. B. Josephson, research engineer, The Pennsylvania State College, State College, Penn.

W. A. Harper, sales promotional work, Hart-Parr Co., Charles City, Ia.

Gottlieb Muehleisen, president and general manager, National Soil Conservation Co., Alma, Wis.

R. L. Perry, instructor in agricultural engineering, Oregon Agricultural College, Corvallis, Ore.

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the November issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

D. E. Blandy, rural service division, Adirondack Power & Light Corporation, Schenectady, N. Y.

Celia S. Bush, home economist, Estate Stove Company, Hamilton, Ohio.

F. L. Ferguson, drainage director for Ontario, Ontario Agricultural College, Guelph, Ontario, Canada.

J. de la Fuente, mining engineer and joint manager of Manuel de la Fuente e Hijo, Ave. Juarez 609, Torreon, Coahuila, Mexico.

R. R. Norris, field manager of sales for Rotary Plow Mfg. Co., 1006 Hobart Bldg., San Francisco, California.

L. M. Marble, president, The Marble Laboratory, Canton, Penn.

W. P. Young, head of W. P. Young & Son, agricultural chemistry and farm machinery, 487 N. Charlotte St., Pottstown, Pa.

Transfer of Grade

R. H. Black, assistant chief marketing specialist, U. S. Department of Agriculture, 406 Flour Exchange, Minneapolis, Minn.

H. H. Doughty, tractor lubrication engineer, Standard Oil Company, Peoria, Illinois.

F. W. Duffee, associate professor of agricultural engineering, University of Wisconsin, Madison, Wis.

J. P. Fairbank, extension specialist in agricultural engineering, University of California, Davis, Cal.

J. F. Goss, assistant professor of agricultural engineering, South Dakota State College, Brookings, S. D.

Frank C. Kingsley, assistant in farm mechanics department, University of Illinois, Urbana, Ill.

C. G. Krieger, Jr., sales and service engineer, H. C. Nash Motor Co., 426 Queen St., Portsmouth, Va.

G. W. McCuen, professor of agricultural engineering, Ohio State University, Columbus, Ohio.

E. G. McKibben, junior agricultural engineer, University of California, Davis, Cal.

C. R. Olson, consulting agricultural engineer, 909 S. Wabash Ave., Urbana, Illinois.

L. G. Samsel, copy writer, J. I. Case Threshing Machine Co., Racine, Wis.

A. J. Schwantes, assistant professor of agricultural engineering, University of Minnesota, St. Paul, Minn.

B. M. Stahl, instructor, The Ohio State University, Columbus, Ohio.

W. H. Willis, engineer, charge Del Mar Subdivision, Box 253, Corpus Christi, Tex.

F. J. Zink, field engineer, Iowa Engineering Experiment Station, Iowa State College, Ames, Ia.

Book Reviews

"Modern Pise-Building," by Karl J. Ellington, Port Angeles, Washington, is published by the author. Among the writings on this subject, this book has the distinction of being modern not only in the time of its writing but in the experience on which it is based. The chapters on the history of pise embrace not only examples of varying and sometimes considerable antiquity, but also a recital of the renaissance of pise building in various countries since the World War. Among the technical information presented, that of the judging of soil to be used, its preparation and blending if necessary, seem most valuable. In the author's experience the design of ramming tools is important, and although these are simple tools, exact specifications and dimensions are given of those which the author has found most satisfactory. Similarly, the forms or moulds are specified and illustrated in some detail and the method of procedure for all parts of the work described. Attention is given to details of door and window openings, joists, supports, foundations, and roof supports, and some attention is given to the matter of exterior and interior finish, also partition walls, in which connection is introduced the matter of pise block making and usage. There are slightly over 100 pages of text matter, with numerous illustrations The book is bound in paper and the price is $3.00 postpaid.

"Electric Development as an Aid to Agriculture" is the title of a new book by Guy E. Tripp, chairman of the board of directors, Westinghouse Electric and Manufacturing Company, just issued by G. P. Putnam's Sons, New York, New York. The volume outlines the views of Mr. Tripp on the influence that modern electric power developments may be expected to have on American agriculture. The book is a compilation of five addresses which Mr. Tripp has delivered on the subject of rural electrification and includes the following titles: "Power on the Farm," "The Farm Problem," "Restoring the Balance Between Industry and Agriculture," "Power and Its Distribution," "The Future of National Electric Service." Complimentary copies are being sent to a limited number of those believed to be interested in the subject by the Westinghouse Electric & Manufacturing Company, 150 Broadway, New York, New York.

MacRae's Blue Book and Hendricks Commercial Register (consolidated) is the first consolidated edition of two well-known purchasing guides just published by MacRae's Blue Book Company, 18 East Huron Street, Chicago, Illinois. The new consolidated edition contains 2264 pages, measuring 8½ by 11 by 4 inches, and weighing 11 pounds. The address section in the fore part of the book consists of an alphabetically arranged list of approximately 75,000 important manufacturers' home office, addresses and in many instances the names and addresses of local distributors for their product. The classified material section of nearly 17,000 pages lists approximately 15,000 different kinds of materials with the names of prominent manufacturers listed alphabetically to meet these classifications. The trade name section in the back of the book contains trade names of approximately 75,000 products together with the manufacturers thereof, thus enabling those who remember only the trade name of the product to find the manufacturer.

Employment Bulletin

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of AGRICULTURAL ENGINEERING. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members as well as members, are privileged to use the "Positions Open" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

Men Available

AGRICULTURAL ENGINEER, married, age 29, 1922 graduate of Iowa State College in agricultural engineering, now assistant engineer in construction department of International Railways of Central America, desires position where permanent residence is possible, preferably experimental or production work, or management of reclamation project or large ranch. Ten years experience in general farming with power equipment, experimental and teaching work, and construction work. Can speak Spanish, also some French and German. MA-130.

WORKS MANAGER available. Seventeen years experience in the designing and manufacture of tractors, harvesting machines, and earth-working tools. Sales experience in United States, Canada, England, France, and Italy. Write for interview. MA-132.

AGRICULTURAL ENGINEER, graduate of University of Illinois, nine years teaching experience as assistant professor in one of the largest universities of the central west. Eleven years manufacturing experience with one of the large tractor and farm implement builders. Experienced in production, design, and management. Desires position preferably as extension agricultural engineer or experimental or production manager work. MA-133.

AGRICULTURAL ENGINEER, single, age 26, graduate of University of Nebraska, College of Agriculture, with two years' practical experience in advertising and sales work, would like position in similar work preferably in South or Central America. Very good at drafting, designing, and photography of farm implements. Can speak a little Spanish. Has had a few articles published. Would submit samples of work. MA-134.

AGRICULTURAL ENGINEER, 1926 graduate from Virginia Polytechnic Institute, desires position in some branch of agricultural engineering, preferably farm power and machinery. President of V.P.I. Student Branch of A.S.AE. in his senior year. MA-136.

AGRICULTURAL ENGINEER, single, age 22, 1926 graduate of Ohio State University, Department of Agricultural Engineering, looking for temporary or permanent work. Particularly interested in rural electrification. Further information furnished upon request. MA-137.

Positions Open

AGRICULTURAL ENGINEER wanted to fill position at Preston, Cuba. Knowledge of Spanish desirable but not absolutely necessary. Farm experience, knowledge of gas and steam engines, and such machinery as ordinarily used on large sized farms is essential. Salary $150.00 to $175.00 per month, according to experience. Single man preferred. PO-116.

AGRICULTURAL ENGINEER wanted to divide his time between teaching and investigational work. He will handle instruction work in farm machinery and a research problem in rural electrification. The position to be filled by January 1927. Good salary for experienced man. Write C. E. Seitz, department of agricultural engineering, Virginia Polytechnic Institute, Blacksburg, Virginia.

DRAFTSMAN wanted by Midwest manufacturing concern with experience in planning dairy barns, hog and poultry houses. Write fully stating years of experience, previous employment, age, salary expected, and other details of interest. PO-118.

DESIGNING ENGINEER wanted by a large machinery manufacturer, contemplating the development of a combined harvester-thresher. A high-class designer with extensive experience is desired. PO-119.

AGRICULTURAL ENGINEER, a recent agricultural engineering graduate, wanted as draftsman and farm building designer by agricultural engineering department of one of the leading state colleges. Applicant must be a man who can develop into more responsible work and must have practical knowledge and an agricultural viewpoint on agricultural engineering problems. PO-120.

WANTED mechanical designer experienced in layout work in connection with tractor design. Location Middle West. PO-121.

Engineering
Library

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AGRICULTURAL ENGINEERING

THE JOURNAL OF THE
AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

United We Stand

THE formation from time to time of divisions in our Society is the mark of strength and growth, even as the admission of states to the Union. And as the strength of a state is the strength of the Union, so lies the strength of the specialized phases of our profession, represented by the divisions, in the broad organization of the Society as a whole. The divisions concentrate; the Society correlates—and none knows better than the engineer how futile is specialization without coordination. Our emblem alone betokens the harmonization of all engineering, be it civil, mechanical, or electrical, into unified effort for the furtherance of agriculture and the betterment of farm life. In that unity lies alike the effectiveness of our work and the prestige of our profession.

DECEMBER-1926

What Makes a Bargain?

BEING a modern farmer, you will be buying more machinery one of these days. Being also a shrewd buyer, you will try to get the greatest value for your money.

What qualities give a machine value?

Because it is important that you get all your work done, it must be adapted to your conditions. To cut down the overhead, it must be both durable and dependable. To do your work cheaply, the operating expense must be light. It must be simple and easy to handle, to save time and labor.

The machine that combines these four qualities to the highest degree will be the best and cheapest machine you can buy, regardless of price, because it will have the greatest working capacity; will last the longest; will enable you to make and save the most money. That's a real bargain.

This Company, which has been serving farmers for 85 years, asks nothing more than a chance to prove to you the superior value and greater earning capacity of Case machines—tractors, threshers, combines, silo fillers, baling presses and Grand Detour plows and tillage implements.

We want your business, but only on the basis that you can make more money with a Case machine. Drop us a line, and leave the proof to us.

Established 1842

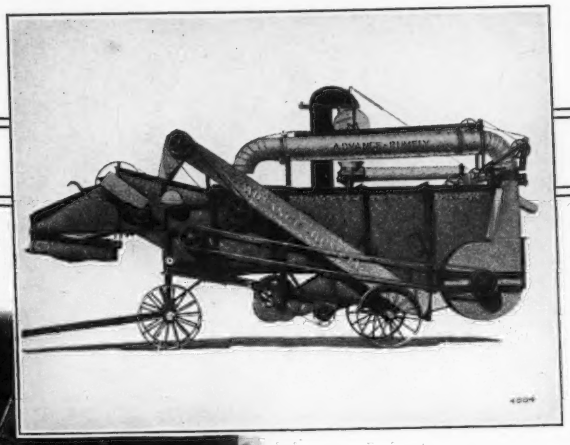
NOTE—Our plows and harrows are NOT the Case plows and harrows made by the J. I. Case Plow Works Company.

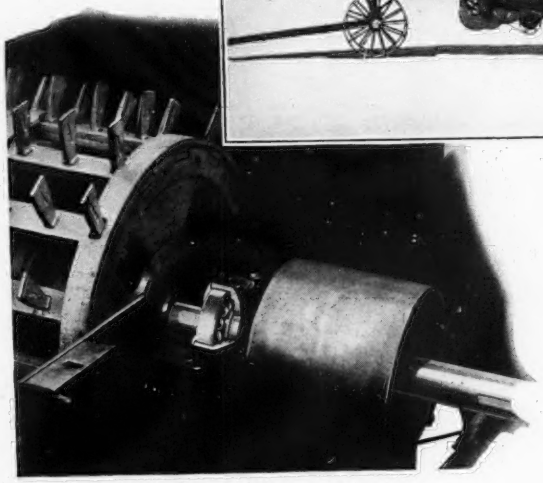
J. I. Case Threshing Machine Co., Inc.

Dept. Z58 Racine Wisconsin

CASE

TRADE MARKS REG. U. S. PAT. OFF. AND IN FOREIGN COUNTRIES





Advance Rumely Thresher Cylinder on New Departures

Grease—lubricated
Only Once a Year,

New Departures Prevent Wear In Farm Machinery

THE prevalence of dust, dirt and chaff about farm machinery makes the bearing design an important consideration.

When plain bearings were used in threshing machines, for instance, the chaff would tend to absorb the lubricant and dirt, working its way into unprotected bearings, causing premature wear to both bearings and shafts.

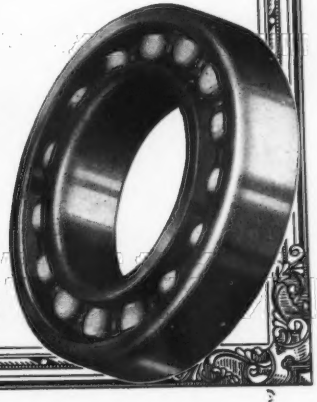
Now, it has been demonstrated that New Departure Ball Bearings lend themselves to absolutely tight enclosures. Furthermore, they can be successfully operated with grease instead of oil.

These facts and the ability of New Departures to hold cylinder and windstacker blades permanently in correct alignment have led manufacturers of high grade threshers to use New Departures extensively.

New Departure engineers have issued technical application data on all types of farm machinery. A complete set will be sent upon request.

THE NEW DEPARTURE MANUFACTURING COMPANY
Detroit Bristol, Connecticut Chicago

New Departure Quality Ball Bearings



472

The passing of

THE traditional scene of stern parental discipline, chief of the irksome burdens of ever restless youth—the wood shed—is joining the ranks of things about to pass.

No longer will there be trouble about "keeping that wood box filled." The turn of a lever and the snap of a switch have replaced the work of blistered hands and aching backs—for this is the age of electricity.

On farms where electric power is available, sawing and splitting wood is no task where a motor does the work.

The Committee on Relation of Electricity to Agriculture is composed of representatives of the U. S. Depts. of Agriculture, Commerce and the Interior, Amer. Farm Bureau Federation, National Grange, Amer. Society of Agricultural Engineers, Individual Plant Manufacturers, General Federation of Women's Clubs, Amer. Home Economics Ass'n., National Ass'n. of Farm Equipment Manufacturers, and the National Electric Light Association.

NATIONAL ELECTRIC

29 WEST 39TH STREET

the wood shed

The hand pump, the lantern and the wood shed have too long been the symbols of life upon the farm. Youth wants time to make its dreams come true.

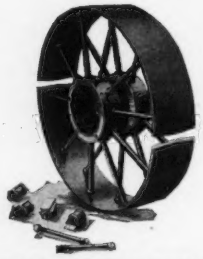
But all farming sections are not equally ready for the building of rural electric lines.

The combined efforts of farmers and the expert assistance of their local light and power companies are, however, bringing electricity to an even greater number of farms.

LIGHT ASSOCIATION

NEW YORK - N. Y.

PROGRESS

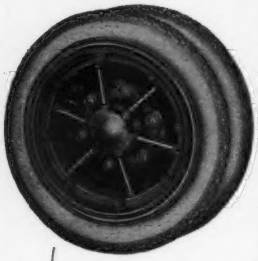


French & Hecht Expansion Wheel Without Rubber Tire

...L., NOVEMBER 8, 1894. COPYRIGHT, 1894, BY FARM IMPLEMENT NEWS CO. $2.00 PER YEAR SINGLE COPIES 5 CENTS

BETTENDORF METAL WHEEL CO.,

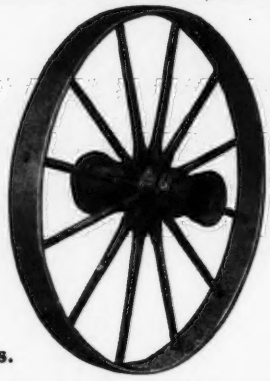
French & Hecht Farm Implement Wheel



French & Hecht Dual Motor Bus Wheel

Farm Truck Wheels With... 4-inch Tire. 30, 34, 38 Inch Diameter.

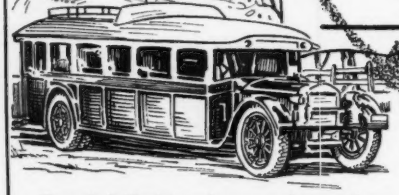
Write For Prices.

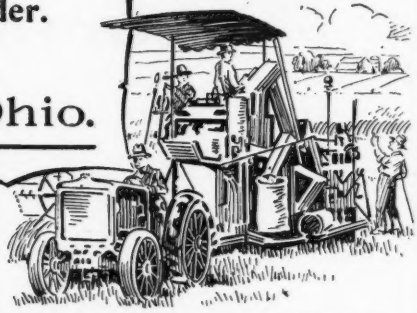


Metal Wheels For All Purposes Made To Order.

French & Hecht Expansion Wheel With Rubber Tire

Davenport, Iowa, AND Springfield, Ohio.



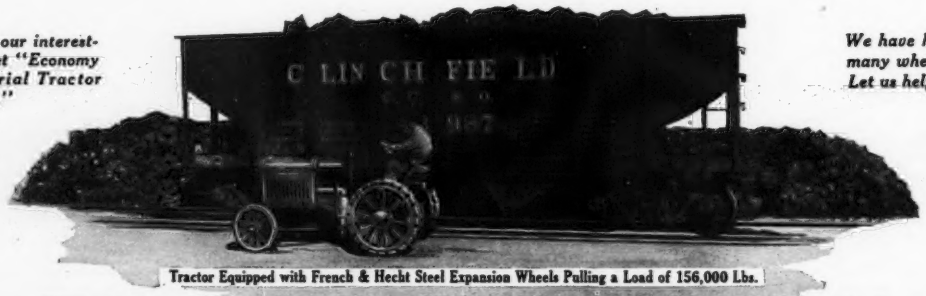


French & Hecht engineers and executives ever mindful of the PROGRESS of the times have assisted to a great degree in the rapid development and improvements in agriculture, industry and automotive transportation.

Way back in 1894, right after the Chicago Fair, this ad appeared in this magazine. It is interesting to note how the Bettendorf Metal Wheel Co. has grown into what is today the big plant of French & Hecht Co. For more than a quarter of century many of the leading manufacturers of farm equipment have been and still are using French & Hecht Built Up Steel Wheels exclusively.

French & Hecht Expansion Wheels are the last word in the wheel of progress. They are the result of careful engineering study and experience gained in the exclusive production of steel wheels on a quantity basis, for more than 38 years.

Write for our interesting booklet "Economy in Industrial Tractor Operation"



We have helped solve many wheel problems. Let us help solve yours

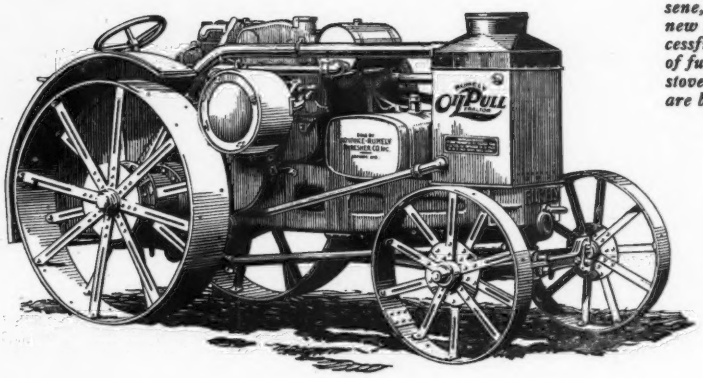
Tractor Equipped with French & Hecht Steel Expansion Wheels Pulling a Load of 156,000 Lbs.

FRENCH & HECHT

WHEEL BUILDERS SINCE 1868

DAVENPORT, IOWA SPRINGFIELD, OHIO

More Powerful Tractors
MEAN GREATER PROFITS



With increasing prices for kerosene, OilPull owners are finding new economies in OilPull's successful burning of cheaper grades of fuel than kerosene. Distillate, stove tops and other cheap fuels are being used by many owners with real success.

Winning on sheer merit

What is behind the substantial increase in sales with which OilPull closes its most successful year?

What is the reason for the great popularity of this tractor, which sales figures of Advance-Rumely dealers prove in a way that leaves no doubt?

Why the unanimous approval which OilPull continues to win among increasing thousands of users?

Seek the answer in OilPull, itself. Don't be content simply with the fact that this year's sales top all records. Or the fact that OilPull popularity is undisputed. Or the fact that users everywhere give this tractor an unprecedented endorsement.

Make your final decision only after you *know* this tractor. Look into the OilPull. Find out why the OilPull excels in everything the modern tractor user demands. Do this, and you cannot fail to be convinced that OilPull's success rests on sheer merit! Address Dept. BK.

Advance-Rumely Thresher Co., Inc.
(Incorporated)
La Porte, Indiana

The Advance-Rumely line includes kerosene tractors, steam engines, grain and rice threshers, combine harvesters, husker-shredders, alfalfa and clover hullers, silo fillers, corn shellers, motor trucks and tractor winches.

Serviced Through 33 Branches and Warehouses

ADVANCE-RUMELY

A Blacksmith's Vision

AT the general store of the Illinois frontier village, just across the street from John Deere's blacksmith shop, people of the new settlement had gathered, to trade and talk of many things.

Reminiscences of events "back East" . . . doings of Blackhawk's Indians on the nearby reservation . . . the government land sales . . . the exploits of Andrew Jackson . . . qualifications of Martin Van Buren . . . the probable duration of the financial panic . . .

And especially, since they were all interested in farming, they talked of John Deere's efforts to perfect his new-fangled steel plow so that it would work under all conditions in the rich, black, "greasy" prairie soil.

ꝺ ꝺ

They saw him coming and going with trial plows every day. Above the hum of the saw-mill, they could hear him hammering in the shop.

"He'll never do it", said one. "Besides, the old plows work all right in timber land, and there is plenty of timber to be cleared off in this country."

"Deere's got the right idea," said another, "but, my gracious, where will he get the steel? It would have to come all the way from England."

"I told him the other day," said a third, "'Damn the odds, John; why all this trouble and hard work? Your plows are good enough; you're the only blacksmith around here, and the farmers will have to take what you make.' And he said: 'They won't ever have to take what I make, but they will take it if I build a plow that will do perfect work in this prairie soil, and that's what I'm going to do.' "

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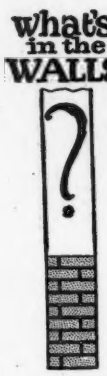
That was the vision, the rugged honesty and the unfaltering determination from which resulted the John Deere steel plow in the various shapes which became the world's standards—the steel plow which conquered the wilderness and became a leading factor in making America the greatest of nations.

Later John Deere expressed the same spirit in his familiar maxim, "Build the best and the trade will be quick to appreciate it," and today the same significance is back of the John Deere trade-mark, the badge of quality which goes on every unit in the complete line of John Deere Farm Equipment.

JOHN DEERE FARM EQUIPMENT

Leader in Quality for nearly a Century

JOHN DEERE
MOLINE, ILL.



Send for *free* copy of *"Building Economy"*—[latest edition], complete description and many photos of effect of Florida hurricane on all types of construction.

Cyclone plays hallelujah with the buildings on this farm

But Look at the Silo!

OUT of the skies, with little or no warning, came a twister, shrieking like a thousand devils—gnashing the farmhouse and outbuildings to pieces.

Towering all alone over the wreckage stands the Silo—an invulnerable column of *Brick* — another real lesson on the choice of building materials. It was the only thing on the farm that was built of Brick.

To be of helpful service to all Agricultural Engineers, who in turn are rendering such fine service to the nation's farmers, we have organized a special department under the direction of an able engineer, who is familiar with all phases of sound, economical construction applicable to farms.

When any question of building arises, call upon us for any information or suggestions you may wish. This new department is *your* department. *We invite inquiry.*

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Norfolk, Va.	112 West Plume Street
Philadelphia	303 City Centre Bldg.
Portland, Ore.	906 Lewis Building
Salt Lake City	301 Atlas Blk.
San Francisco	932 Monadnock Bldg.
Seattle, Wash.	913 Arctic Bldg.

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BRICK forever

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2172 Guarantee Title Bldg., Cleveland, O.

Dept. of Farm Bldgs.

Please send me the books checked below, for which I enclose the price indicated.

☐ *Brick, How to Build and Estimate* (25c)

☐ *Farm Homes of Brick* (5c)

☐ *Brick Silos* (10c)

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Address _____

"Our experience leads us to believe the FARMALL will Revolutionize Corn Belt Farming"

—says the Rushville Implement Co., Rushville, Ind., one of the most successful McCormick-Deering dealers in the United States. This firm sold the Farmall used to such good advantage by Dolph White, Glenwood Indiana.

Dolph White's Experience with the Farmall

HERE is what the FARMALL did (up to June 18) for Dolph T. White, Glenwood, Ind., who for several years had operated a 187-ACRE FARM with an 8-16 TRACTOR and 6 HORSES and a HIRED MAN.

This spring he bought a FARMALL with cultivating and mowing attachments, **sold 4 horses and the 8-16,** and went to work. He plowed 80 acres of corn ground 7½ inches deep, disked, culti-packed, and dragged thoroughly, making a seed bed impossible to make with any 5-horse team. He planted the 80 acres of corn in 6 days with the FARMALL. With the mower attachment on the FARMALL he cut his hay crop. He does his own chores and is feeding 65 head of hogs and a herd of cattle. Just before his corn came up he put a culti-packer and rotary hoe behind the FARMALL and went over 30 to 40 acres a day, perfecting the surface. When the corn was 4 inches tall he went over it twice again with rotary hoe only. When the corn was 9 to 12 inches high he began cultivating over 20 acres a day with the FARMALL and cultivating attachment.

Dolph White has used his 2 remaining horses 6 days only, and used a hired man 3 days only. HE ESTIMATES HIS SAVING IN CROP PRODUCTION, IN HORSE FEED, AND IN HIRED HELP, THIS YEAR ALONE, TO BE OVER $500. All because of the FARMALL.

The enthusiasm of the Rushville Implement Company over the FARMALL prompts them to say, "Power Farming and the new equipment available now will do the farmer more good than all the farm relief measures that could ever be passed by Congress."

INTERNATIONAL HARVESTER COMPANY
of America
606 So. Michigan Ave. (*Incorporated*) Chicago, Ill.

The New 4-Cylinder McCormick-Deering

FARMALL

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Albany Malleable Iron Co.	Voorheesville, N. Y.
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American Malleable Castings Co.	Marion, O.
American Malleables Co.	Lancaster, N. Y., and Owosso, Mich.
Badger Malleable & Mfg. Co.	South Milwaukee, Wis.
Belle City Malleable Iron Co.	Racine, Wis.
Chain Belt Co.	Milwaukee, Wis.
Chicago Malleable Castings Co.	West Pullman, Chicago, Ill.
Columbia Malleable Castings Co.	Columbia, Pa.
Columbus Malleable Iron Co., The	Columbus, O.
Danville Malleable Iron Co.	Danville, Ill.
Dayton Malleable Iron Co., The	Dayton, O., Ironton, O.
Decatur Malleable Iron Co.	Decatur, Ill.
Devlin Mfg. Co., Thomas	Philadelphia, Pa.
Eastern Malleable Iron Co., The	Naugatuck Malleable Iron Works, Naugatuck, Conn.; Bridgeport Malleable Iron Works, Bridgeport, Conn., Troy Malleable Iron Works, Troy, N. Y.; Wilmington Malleable Iron Works, Wilmington, Del.; Vulcan Iron Works, New Britain, Conn.
Erie Malleable Iron Co.	Erie, Pa.
Federal Malleable Co.	West Allis, Wis.
Fort Pitt Malleable Iron Co.	Pittsburgh, Pa.
Fraser & Jones Co.	Syracuse, N. Y.
General Electric Co.	Erie, Pa.
Glancy Malleable Corporation	Waukesha, Wis.
Illinois Malleable Iron Co.	Chicago, Ill.
Iowa Malleable Iron Co.	Fairfield, Ia.
Kalamazoo Malleable Iron Co.	Kalamazoo, Mich.
Laconia Car Co.	Laconia, N. H.
Lakeside Malleable Castings Co.	Racine, Wis.
Link-Belt Co.	Indianapolis, Ind.
Marion Malleable Iron Works	Marion, Ind.
Moline Malleable Iron Co.	St. Charles, Ill.
National Malleable & Steel Castings Co., Cleveland, O., Chicago, Ill., Indianapolis, Ind., Toledo, O.	E. St. Louis, Ill.
Northern Malleable Iron Co.	St. Paul, Minn.
Northwestern Malleable Iron Co.	Milwaukee, Wis.
Peoria Malleable Castings Co.	Peoria, Ill.
Pittsburgh Malleable Iron Co.	Pittsburgh, Pa.
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Rockford Malleable Iron Works	Rockford, Ill.
Ross-Meehan Foundries, The	Chattanooga, Tenn.
St. Louis Malleable Casting Co.	St. Louis, Mo.
Standard Malleable Castings Co.	Terre Haute, Ind.
Stowell Co., The	South Milwaukee, Wis.
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Symington Co., The	Rochester, N. Y.
Temple Malleable Iron & Steel Co.	Temple, Pa.
Terre Haute Malleable & Mfg. Co.	Terre Haute, Ind.
Trenton Malleable Iron Co., The	Trenton, N. J.
Union Malleable Iron Co., The	E. Moline, Ill.
Vermilion Malleable Iron Co.	Hoopeston, Ill.
Wagner Malleable Castings Co.	Hammond, Ind., and Beloit, Wis.
Warren Tool & Forge Co.	Warren, O.
Webster Mfg. Co., The	Chicago, Ill.
Wisconsin Malleable Iron Co.	Milwaukee, Wis.
York Mfg. Co.	York, Pa.
Zanesville Malleable Co.	Zanesville, O.

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One of the Most Interesting Stories of American Industry

The new book, "Certified Malleable Iron," is an entirely new kind of industrial story. It is more than an advertising book and more than a technical bulletin.

It is a complete and authoritative account of the origin, development, valuable properties, methods of manufacture and uses of Certified Malleable.

Illustrated with over ninety photographs, clearly and simply written and carefully indexed to give just the information you want. It will prove intensely interesting to every executive, engineer, student and to the man interested in stronger, lighter and more economical materials.

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CRANE *Automatic* WATER SYSTEMS

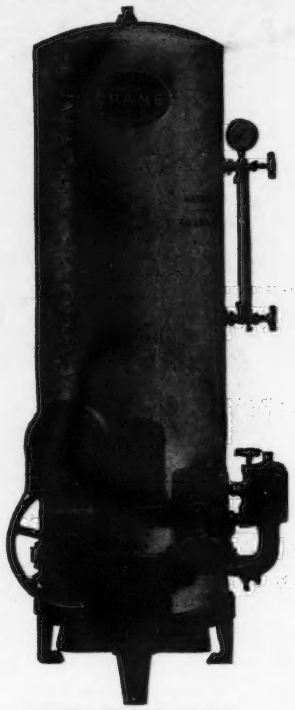
Homes
that will keep them down on the farm

The exodus of young men and women from farms, lured to the cities by apparently easier living conditions—paradoxically matched by the ceaseless, bitter struggle of city dwellers to win sufficient money to enable them to establish country homes—is a national problem. To many rural families it is more than that,—a personal and pressing concern.

Is it one of your problems? Then solve it by giving your home comforts and possibilities of healthy pleasure to defeat the lure of the city. The automobile and radio are helps. But even more important are the conveniences summed up in plumbing.

Crane Farm Water Systems, supplying running water efficiently and economically, have opened the way to bathrooms, laundries, and kitchens that make farm homes as comfortable as those of the city. And the cost is more than covered by increased returns from stock, poultry, and garden,—not to speak of the labor saved man, woman, and beast.

Investigate this possibility. Write for the booklet: "Bringing Comfort and Health to Farm Homes."



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200 gallons an hour capacity.
⅙ horsepower, f.o.b. factory $120

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SINCE the load always comes on the clutch first and then on the engine, it is highly important.

(a) that the clutch be powerful enough to take the maximum strain required, without undue wear, overheating or damage, and

(b) that it be flexible enough in its action to protect the engine from harmful shock and strain.

The design of the twin Disc clutches provides both these advantages

TWIN DISC CLUTCH COMPANY
RACINE WISCONSIN

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Wear The Emblem

Every agricultural engineer who is a member of the American Society of Agricultural Engineers, should wear the official emblem of the Society. It identifies him with the national organization representing his chosen profession; it helps to give him standing in his profession. The price of the official A.S.A.E. emblem is $2.50, equipped with screw post and button back; or $3.00, equipped with jeweler's safety catch pin. Order from

AMERICAN SOCIETY
OF AGRICULTURAL ENGINEERS
St. Joseph, Michigan

"Over the Fence"—*by* T. W. STILLWELL

WHILE Farmer Jones and Farmer Brown were haying close together,
They stopped to talk across the fence about the crops and weather.
The while they rested up a bit, as farmers like to do,
And gossip some, and speculate, and take another chew.

Said Farmer Jones to Farmer Brown, "I'd really like to know
Just why you're so successful, just how you make things go.
Most everything suceeds with you, to which you turn your hand,
You've made this farm the best there is—the pride of all the land.

"You have the finest buildings found around here anywhere.
The kind of stock you market, makes us all sit up and stare.
You raise more grain upon your land than any others do—
A real successful farmer, we doff our hats to you."

Said Farmer Brown to Farmer Jones, "It may not seem good sense,
The reason that I do quite well is, just this good old fence.
With due deliberation I am bound, I think, to say,
The fence I've built has made for me just what I have today.

$250.00

T. W. Stillwell of Wentworth, S. D., won $250.00 in cash for this Second Prize Story in the Keystone Steel & Wire Company's $1500.00 Prize Essay Contest on "The Advantages of a Well Fenced Farm." If you are interested write for the names of other prize winners and reprints of their stories.

"It cost me time and labor, and yet I have to thank
It for the money I have saved and placed down in the bank.
It sent the boys to college, and the girls to Normal, too,
And if you'd do as I have done, 'twould do as much for you.

"You know that I have always claimed, and still I like to say,
Each spear the land produces must be somehow made to pay.
And while you take from out the soil just all that it will stand,
You must put something back that will build up the ravished land.

"And so I build good fences, and try to plan and work,
To change what others mostly waste to mutton, beef and pork.
And though I make my money through the hog and sheep and steer,
I find my soil is better, getting richer every year.

"I never sell a pound of grain, as other people do,
I often have to buy a lot to take my cattle through
I never have to sell my corn at ten or twenty cents,
For I can get a dollar, just by keeping up my fence.

"When harvest comes upon us, and in haste we have to reap,
There's nothing goes to waste, because I keep a band of sheep.
So, when the grain is taken off, and safely in the bin,
To save the last blame kernel, I have just to turn them in.

"And, while they gather every head the men have left about,
They also harvest all the weeds, and clean the mustard out.

And, while they help me kill the weeds that others have to pull,
They turn them into money through a bumper crop of wool.

"I stretch a fence right through my corn, quite early in the Fall,
And turn the shoats into one part and let them take it all.
At first, the neighbors laughed at me and sometimes they would scoff,
But now, I see that every one is trying 'hogging off.'

"No scrubby bulls or mangy boars can trespass much on me,
And leave their after bad effects, in doubtful progeny.
So, when I sell my blooded stock, the buyer can be sure
He gets the very best there is, and blood that's simon pure.

"My chickens search throughout my fields for bugs upon the grass,
But cannot venture on the road where speeding autos pass.
And every bloomin' rooster that we hatch may live to see
The day when he is fit to make a toothsome fricassee.

"I never had a lawsuit over cattle gone astray,
My fences also safely keep my neighbor's stock away.
My sheep are never killed, nor hurt, by dogs that roam about.
I build my fences high and tight, and that has kept them out.

"My orchards and my buildings are safer now by far,
Than those of many farmers, where no fences ever are.
For the prowlers of the night-time never seem to care to stop,
If your fence is high and solid, with a barbwire on the top.

"And then, again, my fences are to me my boundary line.
What's outside may be other, but what's inside is mine.
And a sense of fond possession ever with me will remain,
When I view the friendly acres that make up my small domain."

Said Farmer Jones, "It seems to me, your fence resembles you,
With rugged posts and steely lines, it stretches straight and true.
And though it must have cost you much, of labor and expense,
I think that what you've said of it is plainest common sense.

"I'd surely like to listen to your argument all day,
But now we must get busy, if we finish up the hay.
And I surely will come over, when I get my work in hand,
To have you help me figure how I ought to fence my land."

RED STRAND "*Galvannealed*" Square Deal Fence

surely was the one Mr. Stillwell had in mind when he wrote "Over the Fence." Its much heavier zinc coating must be the thing Brown had to "thank for the money placed down in the bank." Send for copies of the larger prize-winning stories and the free "Official Proof of Tests," showing how nationally known laboratories try fence wire for rust-resisting, long wearing qualities and what they found when they tested "Red Strand." Sent FREE with farm fence catalog.

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An inexpensive but rugged pump for such services as draining excavations, ditches, pits, etc. For pumping sewage, brine, gasoline, kerosene and for general all around service.

Fig. 3010 No. 2
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Described in Bulletin 105. Write for copy.

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For Consulting Engineers

AGRICULTURAL engineers, who are doing consulting work or who wish to build up a consulting practice, will derive much benefit from carrying an advertisement in this Directory of Professional Agricultural Engineers. There is an increasing demand for the services of consulting engineers in the agricultural and allied industries. Those who seek to render service in this field will find that a card in this directory will help to establish their name and service in the profession.

Rates for professional cards like the above—size 1 by 3½ inches—are as follows:

To A. S. A. E. members: $2.00 per insertion for not less than 12 consecutive insertions; $3.00 per insertion for less than 12 consecutive insertions.

To non-members: $4.00 per insertion for not less than 12 consecutive insertions; $6.00 per insertion for less than 12 consecutive insertions.

At Forty

"At forty" the housewife on farms in some sections of Europe wears a black bonnet to signify the end of her youth. She is old—at forty.

Of all the uses of electricity upon the American farm, the most important are those which release the woman from physical drudgery.

A trip to town, an hour's rest in the afternoon—pays a woman dividends in good health "at forty." And what is youth but that?

The uses of electricity which are bringing relief to farm women are constantly growing in number. To the research and experiments which are speeding the progress of rural electrification the General Electric Company has given the full support of its great resources. Write to your local power company for the G-E Farm Book.

GENERAL ELECTRIC

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BECAUSE the appeal of economy is universal, Timken Tapered Roller Bearings are universal.

Economy of fuel and lubricant is assured by overcoming friction with Timken Tapered Roller Bearings.

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